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AN

ACCOUNT OF THE OPERATIONS

CARRIED ON FOR ACCOMPLISHING

A TRIGONOMETRICAL SURVEY

OF

ENGLAND AND WALES,

CONTINUED FROM THE YEAR 1797,
TO THE END OF THE YEAR 1799.

BY CAPTAIN WILLIAM MUDGE,
OF THE ROYAL ARTILLERY, F. R. S.

VOL. II.

ILLUSTRATED WITH SEVEN COPPER PLATES.

FROM THE
PHILOSOPHICAL TRANSACTIONS.

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AN

ACCOUNT OF THE OPERATIONS

CARRIED ON FOR ACCOMPLISHING

A TRIGONOMETRICAL SURVEY.

Read before the ROYAL SOCIETY, *July* 3, 1800.

INTRODUCTION.

HAVING interspersed in the following Paper, with as much attention to brevity as the subject admits, every intelligence relating to the Trigonometrical Survey, I think it unnecessary to swell the bulk of the communication, by giving a long prefatory account of its progress since the year 1796.

The contents of the work now meeting the public eye, are important and numerous: I have divided it into sections. The first contains the calculations of the sides of the principal and secondary triangles extended over the country in 1797, 1798, and 1799; together with an account of the measurement of a new base line on Sedgemoor, and a short historical narrative of each year's operation. The second section contains the computed latitudes and longitudes of those places, on the western coast, intersected in 1795 and 1796, and also such others, since determined, as lie conveniently situated to the newly-observed meridians. This section also contains the directions of those meridians; one on Black Down, in Dorsetshire; another on Butterton Hill, in Devonshire; and another on St. Agnes Beacon, in Cornwall. Among the contents are likewise to be numbered the bearings, distances, &c. of the stations and intersected objects, from the parallels and meridians

The third and last section contains the triangles which have been carried over Essex, the western part of Kent, and portions of the counties joining the former, Suffolk and Hertfordshire. It is with satisfaction I am enabled to state, that Mr. GARDNER, the chief Draftsman, with his assistants, has almost completed the Survey of this extensive tract, which, no doubt, like the map of Kent, will be given to the public: the materials for these different surveys are ample, and will be found in this section, which concludes with the altitudes of the stations and mean refractions.

Before I had advanced far in my work, I entertained ideas of condensing all the *data* in my possession, and distributing them in it; but, when I found my paper would, in that case, be too large for the Philosophical Transactions, I desisted, contenting myself with presenting little more than a moiety: it is even now, of inconvenient magnitude, but I could not, with propriety, still farther abridge it, for I have, in several instances, rejected important matter. I shall, therefore, take an early opportunity of compiling a fourth account, in which will be given the latitudes and longitudes of those places, in Essex, Kent, &c. found in the last section.

It is right, I should observe that, knowing from experience, how liable surveyors are to mistake the names of places, and also, how utterly impracticable it is to detect errors, till the interiors of the great triangles have been *filled up*, I have been cautious to give only the distances of such objects as could not be easily mistaken. I do not mean to insinuate that, among the great number now published, instances may not be found of misnomers, or even wrong bearings; but I rely with great confidence on their general accuracy, and particularly on those constituting the surveys of Essex and the northern shore of the Thames, as the whole of them have been *verified* by Mr. GARDNER. Indeed this is to be understood as holding good throughout the last section, in which are 375 triangles. In our former accounts of this survey, we were particularly guarded in not intermixing their contents with distances determined from numerous doubtful intersections; and experience has hitherto not detected above three or four errors arising from wrong bearings or misnomers. Previously, indeed, to the compilation of them, a great part of the objects in Sussex, Hampshire, and the Isle of Wight, were verified by Mr. GARDNER, in process of an extensive survey, carried on by the order, and performed for the service, of the Board of Ordnance. This gentleman will also have it in his power to detect any errors, if such exist, in the names of places to the westward; as the Master General has been pleased to issue his directions for the survey of Devonshire, and as much of Somersetshire and Cornwall as will *square* the work.

I have mentioned, in the body of the account, that the President and Council of the Royal Society, were pleased to accede to the request made by the Honorable Board of Ordnance, to entrust to my care, the circular instrument used by the late Major General ROY, in his well known operation. It has already been found highly useful, and will shortly prove to be still more so, as one theodolite will be employed in carrying the above orders of Marquis CORNWALLIS into effect, while the other is used in carrying a meridional line through the country: an undertaking begun, and partly executed.

Before I close this Introduction, I am to announce, that Mr. Isaac Dalby, no longer able to endure the fatigues incident to the service, has retired from it; and it would be a matter of injustice, if I were not to acknowledge the extent of his services, his unremitted labour, and attention. But, whilst I lament the loss of a man so perfectly calculated to assist me in this arduous undertaking, I derive every consolation from a knowledge, founded on experience, of the talents and abilities of Mr. Simon Woolcot, his successor.

SECTION FIRST.

1. *Particulars relating to the Operations of the Year* 1797.

The principal object proposed to be accomplished this year, was the determination of the directions of meridians at proper stations, in order to afford the necessary *data* for computing the latitudes and longitudes of places intersected in the surveys of 1795 and 1796.

From errors which are the result of computations made on the supposition of the earth's surface being a plane, it is expedient that new directions of meridians should be observed, when the operations are extended, in eastern or western directions, over spaces of sixty miles from fixed meridians. The distance from Dover to the Land's End being upwards of 300 miles, it becomes necessary, on this principle, that four directions of meridians should be observed; which, with that of Greenwich, amounts to five, dividing this space into six nearly equal parts.

Whatever be the stations farther to the westward, which offer themselves as fit places for these observations, Dunnose in the Isle of Wight presents itself as highly eligible, not only because it is removed the necessary distance from the meridian of Greenwich, but also because it commands a most extensive view of the western coast: therefore, as the direction of the meridian was observed on this station in 1793, (see Philosophical Transactions for 1795, p. 517.) it became necessary to fix on three places only.

In the selection of these stations, it was our wish to have found such as should lie nearly in the same parallel, each intermediate one being visible from those east and west of it; by which means, the differences of latitude between their respective parallels would be accurately determined.

When the party was at Dunnose, in the year 1793, a hill at a very considerable distance, in a direction very nearly west, was seen just rising out of the horizon. It then occurred to us that this spot would, at some future period, be a very proper one for a station whereon a new direction of the meridian might be observed. Experience, in the Survey of 1795, led us to believe this hill was actually Black Down in Dorsetshire; therefore it was determined that our operations should commence at that station, and the event verified the truth of our suppositions.

The party took the field early in April, as observations on the Pole Star, for the purpose in question, are made with superior advantage at this season of the year, because the star comes to its greatest elongations from the meridian at those times, when the sun produces little tremor in the air, by which means, the staff to which the Pole Star is referred, in good weather, is easily perceived.

As the high land in the vicinity of Teignmouth, in Devonshire, cuts off all view of the southern extremity of Dartmoor from Black Down, the necessary alternative was, the firing of lights on some remote station, communicating with Butterton. Rippin Tor was quickly discovered to be the most proper spot; and that eminence would, in every point of view, be a most eligible one for a new direction of the meridian, if the hills in the middle of the moor were not considerably higher. It was, therefore, chosen only with a view of being subservient to the purpose of finding the latitude of Butterton.

In making observations on the Pole Star, the same precautions were taken to ensure accuracy, as were observed at Dunnose and Beachy Head in the year 1793; (see Phil. Trans. for 1795, p. 460.) I shall, therefore, not enumerate them, but content myself with observing, that no pains were spared in this performance.

From Black Down, the party removed to Butterton; at which place but few observations were made, the weather being either tempestuous or hazy, during the greatest part of the time we were at that station: they were, however, made under favourable circumstances, in other respects, and are therefore likely to afford accurate results.

As in the case of Rippin Tor, with respect to Black Down, so Hensbarrow, in Cornwall, was selected as the spot for connecting St. Agnes Beacon with the station on Butterton; for these latter are not visible from each other, the high land about St. Austle, on the northern part of which is situated Hens or Hengist barrow, being higher and intermediate. The staff to which the lights and star were referred, was placed on a hill called Hemmerdon Ball, a secondary station in the series of 1795.

On the 1st of May, the party proceeded to St. Agnes Beacon; at which place the observations were completed on the 8th. The staff for connecting the observations made on the Pole Star with those made on the lights fired at Hensbarrow, was placed near Peranzabulo; which spot is laid down in the plan, Pl. XXVII.

After these directions of meridians were determined, we proceeded with the survey, and from St. Agnes Beacon repaired to Trevose Head, a promontory on the northern coast of Cornwall. The ascent from the sea to the station on this headland being very gradual and unobstructed, we took the opportunity of finding its altitude by means of the transit instrument. The levelling was begun on the 30th of May, and finished the following day; from which operation, it was found that the height of the station above low-water-mark was 274,2 feet; which is, probably, within six inches of the truth. This base of altitude, will afford the means of computing the heights of the stations in the north of Devon, and also of verifying those in the western part of Cornwall. (See Phil. Trans. for 1797, p. 471.)

In giving an account of this and similar articles, it is my intention merely to set forth the order in which the different parts of the survey have been performed. It would be prolix, and perhaps, unnecessary, to assign the reasons for the choice of each station. In the present instance, however, it may not be improper to observe, that a station called Black Down, near Lydford, was selected for the purpose of carrying distances into the north of Devon, by means of the side formed by that station and Carraton Hill. The difficulty of running up the series of triangles from the west, (and it might have been also added, towards the north,) is mentioned in the account of 1797. A tract of country exists in Cornwall, possessing the same characteristic features with Dartmoor, and has thrown in our way equal embarrassments. The station called Carraton Hill, is situated on its southern extremity, from which no part of the north of Cornwall can be seen: it, therefore, became expedient to erect a staff on the top of the rugged hill Brown Willy, (a spot not accessible to the instrument,) and afterwards to content ourselves with *surveying round it.* This resolution became the more necessary, as by means of it, the triangles in the west of Devon will be hereafter connected with those in the north of Cornwall, in a shorter and more direct way than from the sides in the more southern country. In order, therefore, to observe the staff erected on this station, the instrument was taken a second time to Bodmin Down. The station named Cadon Barrow, near Camelford, and those on St. Stephen's Down, near Launceston, were also visited; at which time it was judged expedient to discontinue the operations in Devonshire.

In proceeding along the southern coast, in the years 1795 and 1796, with a single chain of triangles, we acted in conformity with our instructions. It was, in many points of view, the most eligible mode of proceeding; and particularly in that which regarded an early determination of the latitudes and longitudes of the great head-lands in the channel, and also of the Scilly Isles.

When the operations above spoken of were completed, and those instructions carried into full execution, (ample materials being provided for ascertaining the situations of every remarkable point on the English side of the channel,) the want of a spot in the southern part of Cornwall, for the measurement of a base, was felt and regretted; we were, therefore, unwilling to introduce errors, if any should exist, from the sides in Cornwall, into the north of Devon: our operations were consequently discontinued.

From Devonshire we proceeded to the eastward, for the purpose of carrying on a second series of triangles. These were necessarily intended to originate from the side which connects the station on Beacon Hill, near Amesbury, with that on Wingreen Hill, near Shaftesbury.

In the month of July, the observations were completed at the station on the Mendip Hills, after which the instrument was taken to Bradley Knoll; Dundry Beacon, near Bristol; Lansdown and Farley Down; the station on Lansdown being chosen rather for a secondary than a principal place of observation.

From Bradley Knoll, to which place the instrument was carried from Farley Down, we proceeded to Westbury Down, and from thence to Beacon Hill, near Amesbury; because it was necessary that a new point on the range near Marlborough, commonly named St. Ann's Hills, should be observed. The station formerly chosen at the eastern extremity of this range, and observed in 1794, (see Phil. Trans. 1795, p. 471.) was this year found to be useless, as the high land, on the same range, prevented it from being seen at Lansdown: two others were, therefore, selected to the westward of the former, and observed from Beacon Hill; one for the purpose of connecting with Lansdown, and a station near Symmond's Hall, in Gloucestershire; and the other with Inkpin Beacon. The particular circumstances of this range, both as to situation and height, have thrown great impediments in the way of the survey, and are the means of cutting off, in a considerable degree, the connection between the southern triangles and those which have been since carried on in the midland of the kingdom. From Amesbury the party proceeded to Inkpin Beacon, near Hungerford, where the operations terminated.

The stations chosen and observed this year, but not visited with the instrument, were Monymoor, near Penhow; the mountain Twymbawlin, near Newport; and Scilly Point, in Glamorganshire. These stations in South Wales will connect with three in Somersetshire, also selected this season; one on Bleak Down, which is situated on the western extremity of the Mendip range; a second on Brent Beacon; and a third on the Quantock Hills.

Subsequent to the operations on Salisbury Plain, enquiries had been often made after a spot on which a third base might be measured. Experience had almost convinced us that, if Sedgemoor were excepted, the southern part of England did not contain one of sufficient extent for a base of three miles. Aware, therefore, of the imperfect state in which our work must rest, without a fresh base, Mr. DALBY and myself passed over into South Wales, and examined the extensive level between the new Passage House and Cardigan. After, however, a very diligent search, we could not find any spot, four miles in length, sufficiently unobstructed. The advantages which the situation itself holds out, are so great, that we should not have scrupled to dispense with a desideratum, heretofore required, of the base being one continued line. So much, however, is this flat cut up with *rhynes* and ditches, that we were not able to find any point from which two right lines might be measured, and so inclined to each other as to afford, by means of an including angle, a third side of five miles in length: necessity, therefore, compelled us to think of measuring a base on Sedgemoor, which we immediately examined. That which relates to this situation, will be found in an ensuing article: it is now only necessary to observe, that we concluded the operations of 1797, after the practicability of measuring a base upon it had been decided in the affirmative.

ART. II. *Angles taken in the Year* 1797.

At Black Down.

Between		°	′	″	Mean.
Dunnose and Abbotsbury staff		164	26	33,75 37	″ 35,25
Rippin Tor and Abbotsbury staff		3	8	51,75 52,75	52,5
Pilsden and Abbotsbury staff		45	16	15 13	14, but 13 preferred.
Pole star and Abbotsbury staff,	April 17, morning	104	19	26,75	
	18, morning	104	19	19,25	
	19, morning	104	19	33	
	19, afternoon	98	42	47	
	20, morning	104	19	25,25	
	20, afternoon	98	42	35,5	

At Butterton.

Between		°	′	″	Mean.
Hemmerdon Ball and Rippin Tor		121	17	7,25 8,5	7,75
Hemmerdon Ball and Hensbarrow		1	52	2,75 6,25	4,5
Pole star and staff on Hemmerdon Ball,	May 6, afternoon	91	29	13,75	
	7, morning	97	4	14	
	7, afternoon	91	29	12	

On St. Agnes Beacon.

Between		°	′	″	Mean.
Hensbarrow and Trevose Head		47	10	0,75	
Hensbarrow and Peranzabulo staff		31	50	55,5 56,25	56, but 55,5 pref.
Pole star and Peranzabulo staff,	May 20, afternoon	44	0	45,75	
	21, afternoon	44	0	44,75	
	22, morning	38	26	1,5	
	22, afternoon	44	0	33,25	
	23, morning	38	26	9	

At Trevose Head.

Between		°	′	″	Mean.
St. Agnes Beacon and Hensbarrow		65	43	43,75 47 50	47

Between	°	′	″	Mean
Hensbarrow and Bodmin Down	34	17	45 46	″ 45,5
Bodmin Down and Cadon Barrow	42	33	43 46,5	rejected.
			51,75 52,75	52

At Hensbarrow.

St. Agnes Beacon and Trevose Head	67	6	13,25 13,25	13,25
Bodmin Down and Trevose Head	77	20	17,75 19,25	18,5

At Bodmin Down.

Hensbarrow and Trevose Head	68	21	57,25 59,5	58,25
Trevose Head and Cadon Barrow	71	55	26,75 27	27
Carraton Hill and staff on Brown Willy	52	3 4	59,5 1,25 4,5	1,75
Carraton Hill and picket on Brown Willy	51	36	11 11	11
Cadon Barrow and staff on Brown Willy	30	58	13 13	13
Cadon Barrow and picket on Brown Willy	31	26	0,25 1,25 3,25	1,75

On Cadon Barrow.

Trevose Head and direction post on Bodmin Down	68	7	53,75 54 54,25 54,75	54,25
Direction post on Bodmin Down and staff on Brown Willy	41	12	37,5 39 41	39,25
Direction post on Bodmin Down and picket on Brown Willy	40	40	34 36,75	35,25
Tresparrot Down and staff on Brown Willy	100	20	52,25 55 57	54,75
Tresparrot Down and picket on Brown Willy	100	53	1 1	1

At St. Stephen's Down.

Staff on Brown Willy and Warbstow	41	18	24,25 25,5	25

Between	°	′	″	Mean. ″
Warbstow Beacon and Brendon Moor	39	41	18,5 18,75 19	18,75
Brendon Moor and Broadbury Down	90	0	40,75 41	41
Broadbury Down and Black Down	45	34	36 D 41,75 43	42,25
Black Down and Carraton Hill	91	18	12,25 13,5	12,75
Carraton Hill and Kit Hill	37	1	56	
Black Down and Kit Hill	54	16	13	

At Maker.

Carraton Hill and Black Down	53	4	28 30,5	29,25

At Carraton Hill.

Black Down and Maker Heights	74	5	22,5 22,75	22,5
Trevose Head and Bodmin Down	77	20	17,75 19,25	18,5

At Black Down.

Maker Heights and Carraton Hill	52	50	7,75 11,75	9,75
Carraton Hill and St. Stephen's Down	39	44	37,25 40,75	39
St. Stephen's Down and Broadbury Down	66	49	57,5 58,25	58
Carraton Hill and Kit Hill	13	12	58	

On the Mendip Hills.

Dundon Beacon and Bleak Down	85	15 16	59,25 59,75 1,5 4,5	1,25
Bleak Down and Brent Knoll	29	11	35,75 38 41,25 41,75	39,25
Bleak Down and Dundry Beacon	33	39	30,5 30,5	30,5

Between	°	′	″	Mean.
Dundry Beacon and Lansdown	41	3	58,5 58,75	″ 58,5
Lansdown and Farley Down	19	32	16,5 17	16,75
Farley Down and Westbury Down	38	55	17 18,25	17,5
Westbury Down and Bradley Knoll	37	47 48	57 57,75 58,75 59 0,25	58,5
Farley Down and Dundry Beacon	60	36	15 15,75	15,5
Farley Down and Bradley Knoll	76	43	14 18,5 21	19,75

At Dundry Beacon.

	°	′	″	Mean.
Tickenham Down and Grey Hill	37	44 3	2,25 3 6,25	3,75
Tickenham Down and Kingsweston	60	3	27,25 30	28,75
Kingsweston and Grey Hill	22	19	23,5 27,75	25,75
Bleak Down and Grey Hill	120	0	23 24 28	25
Lansdown and station on the Mendip Hills	83	34	16,25 19,75	18
Farley Down and Mendip Hills	69	52	21 23	22
Mendip and Bleak Down	54	34	24 25,75	25,5

At Lansdown.

	°	′	″	Mean.
Kingsweston and Dundry	36	38	29	

On Farley Down.

	°	′	″	Mean.
St. Ann's Hill and Westbury Down	51	44	10,75 11 11,25 13,75	11,75
Westbury Down and Bradley Knoll	37	5	30,75 31 34 34,25	32,5

Between	°	′	″	Mean.
Westbury Down and Mendip Hills - - -	77	21	51,75 55,75	53,75
Bradley Knoll and Mendip Hills - - -	40	16	23 23,75	23,5
Mendip Hills and Dundry Beacon - - -	49	31	15,25 21,5	rejected.
			23 23,75	23,5

On Bradley Knoll.

	°	′	″	Mean.
Mendip Hills and Westbury Down - - -	101	23 24	56,5 57,75 0 1,75	59
Westbury Down and Beacon Hill - - -	42	43	29,25 30,5	29,75
St. Ann's Hill and Westbury Down - - -	7	28	44 45,25 46,5	45
Westbury Down and Milk Hill - - -	10	12	49,5 53,25	51,5
Beacon Hill and Wingreen - - -	57	50	38,25	
Beacon Hill and Bull Barrow - - -	98	34	31 33,5 34	32,5
Wingreen and Bull Barrow - - -	40	43	51,25 52,75	52
Bull Barrow and Ash Beacon - - -	45	43	3,25 3,75	3,5
Ash Beacon and Mendip Hills - - -	71	34	54,75 55,25	55
Mendip Hills and Farley Down - - -	63	0	21,5 D.	

At Bull Barrow.

	°	′	″	Mean.
Ash Beacon and Mintern - - -	51	26	41 41,75 43	42
Bradley Knoll and Wingreen - - -	42	55	32,75	

At Pilsden Hill.

	°	′	″	Mean.
Mintern and Ash Beacon - - -	35	2 3	59 3,25	1

At Mintern.

Between	°	'	"	Mean.
Pilsden and Ash Beacon	95	35	21,25 22,5	22
Ash Beacon and Bull Barrow	94	14	22 24	23

On Westbury Down.

Beacon Hill and Bradley Knoll	114	12	18,25 18,5 18,75	18,5
Bradley Knoll and Mendip Hills	40	48	1 1,75 1,75	1,75
Mendip Hills and Farley Down	63	42	50,5 52	51,25
Farley Down and St. Ann's Hill	88	50	1 3 4¼	2,75
St. Ann's Hill and Beacon Hill	52	26	42,25 43,25	42,75
Beacon Hill and Milk Hill	48	7	31 36	33,5

Beacon Hill (Amesbury.)

Bradley Knoll and Westbury Down	23	4	15	
Inkpin Down and Milk Hill	66	14	58	
Inkpin Down and St. Ann's Hill	70	51	57,5 57,75	57,75
Westbury Down and Milk Hill	51	11	9	
Westbury Down and St. Ann's Hill	46	34	6 9,25	7,75

On Inkpin Down.

White Horse Hill and Highclere	133	27	57,25 57,5	57,5
Highclere and Beacon Hill	106	16	52,25 54,25	53,25
Beacon Hill and Hewish	51	53	31,25 33,5 35	33,25

ART. III. *Particulars relating to the Operations of the Year 1798.*

The object first attained this year, consisted in a trigonometrical survey of the counties adjacent to the northern and southern shores of the Thames.

In the last communication it will be seen, that the survey of Kent had been carried on from the sea-coast, till it reached the range which runs eastward from Wrotham through Hollingbourn, and there terminated. The country to the northward could not be surveyed, because the view from General ROY's station at Wrotham is almost entirely cut off, in that direction. In order, therefore, to obtain a base for the purpose, when the party arrived at Wrotham, a new station was chosen, to the eastward of the former one, and the distance between them accurately measured; by which means, together with the included angle at the old station, and the distance of it from Severndroog Tower, on Shooter's Hill, a new distance was found, which became a base for the survey proposed.

The chief draftsmen and surveyors belonging to the Drawing-room in the Tower, attended our operations in this county, and also those afterwards carried on in Essex. It was, indeed, for their immediate service, that we renewed the survey in this quarter, as the Master-General had given directions to prepare ample materials for completing the map which meets the public eye with this article.

The stations in Kent, besides that of Wrotham, were Gravesend, Gad's Hill, and the Isle of Sheppey; those in Essex were Hadleigh, South End, and Prittlewell. Observations made from these places afforded *data* for the proposed survey: after they were completed, the small circular instrument supplied the place of the great one, and was used, with good effect, in carrying on the subsequent operations in this quarter.

In our Paper published in the Philosophical Transactions for 1795, an observation is made, of the necessity then existing for the measurement of a base on Salisbury Plain, in consequence of resolutions taken to inclose Sedgemoor: an act for which purpose was passed a few years ago, and partly carried into execution in 1797. At this time, however, King's Sedgemoor was only set out into parochial allotments, as exhibited in Plate XXVIII. accompanying this Account. The ditches, represented by lines on this plan, were generally ten feet broad, and five feet deep; but the principal and secondary drains were much wider, the first being thirty, and the last twenty-five, feet in breadth. The subdivisions on the Moor, or the individual allotments of it, were not traced out in the Somerton quarter, at this time, the task being deferred till the latter part of the following year. The measurement, therefore, of this base, in an early part of the season, became necessary, because fewer obstacles were then expected to present themselves.

As it appeared that many instances would probably occur, in which a chain of 50 feet in length would be useful, if not absolutely necessary, one was provided by Mr. Ramsden, in the winter; its make and form being precisely similar to those of the larger chains, used in the measurement of our former bases. Such a chain did, indeed, prove highly serviceable in the subsequent operation; as the handles of the 100-feet chain would very often have had their places in ditches, or been so situated on their banks, as to leave imperfect means of correctly placing the register heads under the handles.

The apparatus for the measurement, consisting of the tressels belonging to the Royal Society, pickets, iron heads, and a new set of coffers, were sent to Somerton, after Mr. GARDNER had been furnished with the means of proceeding with the survey before spoken of.

The measurement was begun in July, and finished in August; in the course of which, very little interruption arose from any inclemency of weather. It is unnecessary to enter minutely into a description of the difficulties which arose from the frequent intervention of ditches; let it suffice to observe, that, possessed of the 50-feet chain, these were rendered less material than they would otherwise have been.

When we arrived at that point which ends with the 114th chain, an *offset* was taken, and 19 chains measured, in a direction perfectly parallel to that of the base, at the extremity of which we returned into the base itself, and continued the measurement. This interruption proceeded from an accidental and unforeseen circumstance; a great ditch having been excavated in a direction coincident with that of the base, while the measurement was going on at the upper end of it. This, however, cannot be the means of introducing any sensible inaccuracy; for, to proceed in this matter correctly, when it became necessary to take an offset, a silver wire was let fall from the register head, having a plummet, under the point of which a small dot was made, on a stake driven firmly into the ground. *The great theodolite* was then placed over the stake, *and the instrument accurately adjusted over the dot.* A diaphragm, whose aperture was $\frac{1}{2}$ an inch, was then put over the object-glass of the transit telescope, which was afterwards directed towards the staff at Lugshorn Corner, and then moved round, till it exactly made a right angle with the base. The telescope being sufficiently depressed, a peg was driven into the ground, with its centre nearly under the cross wires; after which, a pin was moved on the surface of the peg, as directed by a person looking through the telescope, till it came to that point at which it bisected the angle formed by the cross wires. The measurement was then carried on, in this new direction, a space of 19 chains, at the end of which, the same operations were repeated, and the old direction pursued. It does not seem probable, that an error amounting to more than $\frac{2}{10}$ of an inch, can have resulted from this procedure.

King's Sedgemoor being sufficiently level, the base was measured horizontally; an advantageous circumstance; but, from the soft texture of the soil, the pickets could not be driven into the ground so firmly as to be without some small degree of motion, in case a person stood close to them. Therefore, those who attended the handles of the chains, either used long stools, or placed themselves so as to divide the pressure arising from the weights of their bodies equally on each side of the pickets. The disturbances to which the register-heads were liable, did not discover themselves till a mile of the base had been measured; and, although it became probable that small errors only had resulted from the want of those precautions we afterwards followed, yet we considered what we had done as erroneous, and recommenced the measurement, with the advantage of experience. At present, I shall content myself with observing, that due attention was paid to all necessary minutiæ in this measurement, and refer those who are desirous of being more particularly informed, to the Philosophical Transactions for 1795, as the mode of proceeding on the present occasion was perfectly similar to that on Hounslow Heath.

After the conclusion of this operation, we proceeded to select such stations in the neighbourhood of the base, as might afford means of connecting it with the triangles carried on in the preceding year. The two chosen for this purpose, were Dundon Beacon, and a spot near the village of Moor Lynch; both nearer to their respective ends of the base than we wished to have found them; yet, as small rods of only an inch in diameter were placed on those stations, when they were observed from Dundon Beacon and Moor Lynch, and the same erected at the ends of the base, when they were observed from those stations, it becomes probable that very trifling errors resulted from this proceeding.

The station at Ash Beacon was visited subsequent to these just spoken of, and afterwards that on the Mendip Hills, for the purpose of taking the angle between Moor Lynch and Dundon Beacon. The operations of 1798 then terminated with a diligent search after some spot in Cornwall, for a base of only two or three miles in length: this search, however, was fruitless, as in fact we had reason to imagine it would prove to be; but we were not willing to relinquish the hope, that a piece of ground might be discovered proper for so confined a purpose. The contrary, however, being the case, the party returned to London in October.

ART. IV. *Angles taken in the Year 1798.*

At Wrotham. Station of 1787.

Between	° ′ ″	Mean.
New Station and staff on Severndroog Tower	94 19 30	

Station of 1798.

Between	° ′ ″	Mean.
Severndroog Tower and Gravesend	62 54 36,5 38,5 39,5	38

At Gravesend.

Between	°	′	″	Mean.
Severndroog Tower and Wrotham	82	39	21 21	21
Severndroog Tower and Langdon Hill	95	53 54	56 59,25 1,25	59
Langdon Hill and Hadleigh	34	31	49,5 52,5 54 57,5	53
Halstow and Hadleigh	30	24	17 19,75 20,5	19
Halstow and Gad's Hill	31	38	19,75 22,25	21
Severndroog Tower and Hadleigh	130	25	50 51,5	50,75

Isle of Sheppey.

Between	°	′	″	Mean.
Gad's Hill and Halstow	18	18	1,5 3 3,5	3
Halstow and Hadleigh	31	28	23 24,5 25	24,25
Langdon Hill and Hadleigh	16	26	30	
Langdon Hill and Rayleigh	27	4	46	

At Halstow.

Between	°	′	″	Mean.
Gad's Hill and Gravesend	24	18	21,25 21,25	21,25
Gravesend and Hadleigh	107	49	5,25 5,25	5,25
Hadleigh and Sheppey	99	18	4 7,5	6
Gravesend and centre of Rayleigh Tower	111	20	14	
Sheppey and Rayleigh Tower	95	46	57	

At Hadleigh.

Between	°	′	″
Sheppey and South End	38	43	29
Sheppey and Halstow	49	13	33,5
Gravesend and Halstow	41	46	32
Langdon Hill and Gravesend	43	11	51

Between	°	′	″	Mean.
Gravesend and Severndroog Tower	26	16	56,75 57,75	″ 57,25
Langdon Hill and Sheppey	134	11	55	

At South End.

Sheppey and Hadleigh	119	20	5	

At Langdon Hill.

Gravesend and Severndroog	53	47	25	
Centre of Rayleigh Tower and Gravesend	122	2	46	
Station on Rayleigh Tower and centre of the same Tower	0	0	27	
Station on Rayleigh Tower and Danbury Spire	43	18	2	
Severndroog Tower and Frierning	95	25	0	
Frierning Tower and Station on Rayleigh Tower	88	44	19	
Frierning and Danbury Spire	45	26	17	
Severndroog Tower and Brentwood Spire	66	26	39	

At Triptree Heath. 1st *Station.*

Tillingham Tower and Station on Rayleigh Tower	68	28	58	
Tillingham and Danbury Spire	100	28	21	
Station on Rayleigh Tower and Langdon Hill	21	25	14	
Station on Rayleigh Tower and Frierning Tower	47	8	50	

At Lugshorn Corner.

Greylock's Foss and Dundon Beacon	107	44	30,75 31,25	31
Greylock's Foss and Moor Lynch	15	51	58,5 59 59,75	59
Moor Lynch and Dundon Beacon	93	52	33,75	

At Greylock's Foss.

Moor Lynch and Lugshorn Corner	114	9	58,25 59,75	59
Lugshorn Corner and Dundon Beacon	8	29 30	59,75 0,5	0
Dundon Beacon and Moor Lynch	105	40	0 0,5	0,25

Near Moor Lynch Windmill.

Between	°	′	″	Mean.
Greylock's Foss and Dundon Beacon	59	58	17,5	
Greylock's Foss and Lugshorn Corner	51	58	2,25 4,25	″ 3,25
Lugshorn Corner and Dundon Beacon	8	0	10 10,25	10,25
Dundon Beacon and Mendip Hills	54	38	50 50	50
Mendip Hills and Ash Beacon	54	3	20 23,5 23,75	22,5
Ash Beacon and Pilsden Hill	57	19	2,5 3,75 4,5	3,5
Dundon Beacon and Pilsden Hill	56	43	36,25 36,5 37,25	36,75
Pilsden and Quantock Hills	87	15	6 7	6,5
Quantock Hills and Brent Knoll	71	38	57,75 58,5 58,5	58,25
Brent Knoll and Bleak Down	46	1	32,75 35,25 39	35,75
Bleak Down and Mendip Hills	43	41	43,5 45 45,25 46,75	45,25
Brent Knoll and Mendip Hills	89	43	19,5 20,5 24	21,25

On Dundon Beacon.

Between	°	′	″	Mean.
Lugshorn Corner and Moor Lynch	78	7	14,75 14,5	14,5
Lugshorn Corner and Greylock's Foss	63	45	28,5 29,5	29
Greylock's Foss and Moor Lynch	108	1	51,25 53	52,25
Moor Lynch and Bleak Down	58	42	10 10,25	10,25
Moor Lynch and Mendip Hills	101	22	54,25 55	54,5

At Ash Beacon.

Between	°	′	″	Mean.
Moor Lynch and Mendip Hills	56	29	50 52,25 52,25	″ 51,5
Mendip Hills and Bradley Knoll	50	8	45,25 45,75	45,5
Bradley Knoll and Bull Barrow	93	38	10,5 13 14	12,5
Bull Barrow and Pilsden	83	40	33,5 35,5	34,5
Mintern Hill and Pilsden	49	21	35,75 39,75 39,75	38,25
Pilsden and Quantock Hills	59	34	40,5 42,25	41,5
Quantock Hills and Mendip Hills	72	57	49,75	

On the Mendip Hills.

Bradley Knoll and Ash Beacon	58	16	20 21,5 24,25	22
Ash Beacon and Moor Lynch	69	26	46,5 49 49,25	48,25
Dundon Beacon and Moor Lynch	23	58	16,5 17,75	17

ART. V. *Particulars relating to the Operations of the Year* 1799.

I have shewn in the preceding articles, that sufficient materials are now in my possession, for calculating the latitudes and longitudes of those places whose bearings and distances from given stations are found in the Account of 1797. I have also pointed out the direction which the survey has subsequently taken; and given a short account of the measurement of a new base in Somersetshire. The operations of 1799 now remain to be spoken of.

In very early stages of the work, I had frequent opportunities of observing, that eminent advantages would accrue to the service, were the survey prosecuted on a more extensive scale. The consideration of a grand instrument being laid up in the apartments of the Royal Society, suggested the propriety of obtaining it; therefore, when my appointment to my present situation gave me the means of effecting former ideas, I lost no time in applying to the President and Council, for the loan of their large theodolite, the excellence of which had been incontestibly demonstrated by the late Major General Roy. The distinguished services which the Royal Society have rendered this branch of the public service, leave it almost unnecessary for me to observe how readily they granted my request. The instrument was, accordingly, put into the hands of Mr. Ramsden, early in the month of January, for the purpose of being examined, and also of having new microscopes fixed to it; the former ones being much inferior, in construction, to those attached to the instrument belonging to Government.

To carry on so extensive a survey as that which is now the subject of this Paper, much consideration is necessary. I have endeavoured to give it the best effect, both as to design, and celerity of execution. What degree of success has attended my endeavours, the public, in possession of this Paper, can readily determine. In the present stage of the survey, I have been sufficiently impressed with just ideas, as to the importance of the task, and responsibility of my situation. The difficulties which start up, in prosecuting a survey of this kind, become more numerous as it becomes more extensive. In the earliest part of it, when few objects only were in view, speedy execution followed the design; but, circumstances now require every exertion, as the triangles are branched out into several parts of the kingdom.

Were the length of a degree of the meridian, in these latitudes, accurately known, the most eligible method of carrying on the survey would be, that of working between any two determined parallels of latitude, till the space between them was completed. Yet this mode would manifestly be subject to some slight innovations, from the necessity of measuring bases in certain stages of the work: it would be right, however, to adopt the principle for general practice. Under this idea, it would have been proper to have commenced the operations of this year in Somersetshire, and to have carried on the triangles from the neighbourhood of the new base into the north of Devon.

It is mentioned in one of the former Accounts, that a zenith sector was formerly bespoken of Mr. RAMSDEN, by his Grace the Duke of RICHMOND, for the purpose of aiding the design of measuring the length of a degree of latitude in this country. The pressure of other business caused Mr. RAMSDEN to lay aside this instrument, after he had considerably advanced in its construction. The real necessity, however, for our being supplied with an instrument of this description being made known to him, he resolved to take it in hand again, and complete it. Relying on the strength of his assurances to this effect, I determined to relinquish the intention of proceeding to the westward; and resolved to commence this year's operations, with running up a series of triangles along the meridian of Blenheim. As it is probable my next communication will contain the result of this interesting part of the survey, I shall now confine myself to such particulars as relate to the subject under consideration.

In a former article, I have observed, that the chief Draftsman, Mr. GARDNER, has been furnished with materials for surveying the northern shore of the Thames, and the north of Kent: these proved ample, as the map, thence compiled, will sufficiently demonstrate. As the Master-General issued directions, at this time, to survey Essex, and parts of the adjoining counties, in the same manner, and for the same purpose, as Kent has been, I was obliged to suspend, for a short time, my intention of proceeding with the measurement of a meridional degree, and to devise the best means for carrying his Lordship's instructions into execution.

For this purpose, therefore, before any stations were chosen in Essex, the county was very minutely examined; when it appeared, that insuperable difficulties would occur, if the survey were prosecuted with the large theodolite only. The range commencing at Havering Bower, and running to Gallywide Common, cuts off a regular communication between the stations subsequently chosen in the southern and northern parts of Essex. The difficulty resulting from this circumstance, was made still greater, from the want of success in our endeavours to find one spot on this range, proper for a station. The eastern part was, in some degree, found more favourable; but it was discovered that, even here, the small instrument must frequently be used as a substitute for the large one. Under these disadvantages, the survey commenced in March; the large theodolite being taken to a station on Hampstead Heath.

The base chosen for carrying on the distances towards the north, was that constituted by Severndroog Tower on Shooter's Hill and the new station on Hampstead Heath; which distance, although it has not, perhaps, been obtained so correctly as many others, yet is determined with sufficient accuracy for the matter in hand. When the observations were made on Severndroog Tower, in the year 1787, the angle between Hanger Hill Tower and the cross on the dome of St. Paul's was taken: this was now made use of, in order to get the angle between Hanger Hill Tower and Hampstead Heath; because the former station could not be discovered, on account of the wind blowing the thick and darkened atmosphere of London between the stations, when the instrument this year was carried to Shooter's Hill.

For the purpose of connecting the eastern and western triangles with each other, a station was chosen on Southweald Tower, accessible only to the small instrument. Brentwood Spire was also found to be conveniently situated for carrying on the distances: this will be readily perceived by the plan. Langdon Hill was also selected; which, with the former station at Gravesend, were to become the means of connecting the triangles. A station on Epping Forest was judged necessary: but no spot could be found fit for general purposes, the view towards the north being confined. One was, however, fixed on, called Highbeech, from which a high building near Berkhamstead was found to be visible, by means of which, the distances in the north of Essex could be verified, as the station on the top of it would connect with Bushy Heath, near Watford, and a point on the elevated range near Dunstable.

From Hampstead, the instrument and portable scaffold were carried to Langdon Hill, and from thence to Triptree Heath, near Malden; from whence the party repaired to Highbeech, leaving the remainder of the county to be surveyed with the small circular instrument; which seems to have been done with considerable accuracy.

After the necessary observations were made at Highbeech, I proceeded to Shotover Hill, in Oxfordshire; and, before May elapsed, had reconnoitred the country. As the distance between Inkpin Hill and Highclere, appeared to be shorter than was necessary for a base on which the northern triangles were to rest, it became certain, that their sides would depend on the base on Hounslow Heath. The only means by which the series now proposed to be carried westwards, (for the double purpose of forwarding the survey, and also of finding a portion of the meridional arc,) could be properly connected with the triangles in the neighbourhood of Salisbury Plain, was the side just spoken of; for the high land in the vicinity of Calne, intercepted the view of the stations on the Marlborough range, from White Horse Hill. In order, however, to make a connection, although imperfect, an intermediate station was chosen on this high intercepting land.

When the ground about Nettlebed was formerly examined by us, it appeared difficult to carry on the triangles from Bagshot Heath towards the northward; because no spot could be found near the former, from which the Chiltern range could be seen. I now, therefore, departed from the usual practice of choosing stations on the ground, and selected Pen Church Tower; by means of which, I found a connection might be made between the triangles carried round the Chiltern range, from White Horse Hill and Nuffield, with those in Hertfordshire.

At Shotover Hill the party separated, each having its instrument. I shall close this article, without entering minutely into the reasons which operated with me for the choice of all the stations selected this year. I shall content myself with enumerating the names of the stations visited and observed, and mentioning that Shotover Hill and Cumner Hill, in Oxfordshire, were selected principally with a view of ascertaining the situations of the observatories at Oxford and Blenheim. The names of the stations were, Nuffield, White Horse Hill, and Scutchamfly, in Berkshire. Shotover Hill, Cumner Hill, Whiteham Hill, Crouch Hill, and Epwell Hill, all in Oxfordshire. Those in Gloucestershire were, Pen, Cleave, Broadway Beacon, and the Malvern Hills. The Lecky Hills, in Worcestershire. Corley and Nuneaton, in Warwickshire. Bardon Hill, Naseby Field and Barrow Hill, in Leicestershire. Arbury Hill, and Souldrop, in Northamptonshire. Quainton, Brill, Wendover, and Bow Brickhill, in Buckinghamshire. Woburn Park, and Lidlington, in Bedfordshire. Kinsworth, Lillyhoe, Berkhamstead, Tharfield, and Bushy Heath, in Hertfordshire. From the last mentioned station, the party returned to London, in October.

ART. VI. *Angles taken in the Year* 1799.

On Hampstead Heath.

Between	°	′	″	Mean.
Hanger Hill Tower and Stanmore - -	50	52	15,75 17	16″,25
Highbeech and Shooter's Hill - -	70	6	35,5 34,5	35
Highbeech and St. Paul's, London - -	83	1	17,25 22,75	20
Severndroog Tower on Shooter's Hill, and Hanger Hill Tower	117	22	13 11	12

At Langdon Hill.

	°	′	″
Gravesend and Severndroog Tower - -	53	47	25
Centre of Rayleigh Steeple and Gravesend - -	122	2	46
Station on Rayleigh Steeple and centre of the same -	0	0	27
Station on Rayleigh Steeple and Danbury Spire -	43	18	2
Severndroog Tower and Frierning Steeple - -	95	25	0
Frierning Steeple and Station on Rayleigh Steeple -	88	14	19
Frierning Steeple and Danbury Spire - -	45	26	17
Severndroog Tower and Brentwood Spire - -	66	26	39

At Triptree Heath.

Between	°	′	″	Mean. ″
Tillingham Steeple and Station on Rayleigh Steeple	68	28	58	
Tillingham Steeple and Danbury Spire	100	28	21	
Station on Rayleigh Tower and Langdon Hill	21	25	14	
Station on Rayleigh Tower and Frierning Steeple	47	8	50	

At Highbeech.

Severndroog Tower and Brentwood Spire	71	16	43 45	44
Severndroog Tower and Southweald	44	34	27 29	28
Severndroog Tower and Hampstead	58	28	18 18	18
Cross on the Dome of St. Paul's and Hampstead	83	1	11	
Berkhamstead Gazebo and Hampstead	138	29 30	57 0	58,5

At Shotover Hill.

Nuffield and White Horse Hill	81	53	27,75 29,75	28,75
Scutchamfly Barrow and White Horse Hill	26	8	7,75 7,75 8,25	8
White Horse Hill and Whiteham Hill	48	5	31,25 32,75 33,75	32,75
Wendover and Scutchamfly Barrow	117	30	55 57,25	56

On Whiteham Hill.

Shotover Hill and White Horse Hill	114	54	34,75 34,75	34,75
Shotover Hill and Cumner Hill	55	52	34,5 35,5	35
Staff over the Quadrant at Blenheim and White Horse Hill	131	25	34,5 38,5	36,5

On Cumner Hill.

Whiteham Hill and Shotover Hill	99	29	47 49,5	48,5
Shotover Hill and Atlas on the Top of the Observatory at Oxford	29	23	34 34	34

On White Horse Hill.

Between	°	′	″	Mean.
Nuffield and Shotover Hill - - -	35	34	22,25 23,75	″23,25
Nuffield and Brill - - -	38	48	11,5 15,25	13,25
Scutchamfly Barrow and Shotover Hill - -	111	47	50	
Whiteham Hill and Staff on Blenheim Observatory -	10	30	43,5 43,5	43,5
Brill and Stow on the Wold - - -	64	45	42,75 44,75	43,75
Station near Calne and Inkpin - - -	67	10	28,5 32,5	30,5
Highclere and Inkpin - - -	12	4	11,25 11,5	11,5
Highclere and Nuffield - - -	63	7	53,25 53,5	53,25

At Nuffield.

Bagshot Heath and Highclere - -	78	17	16,5 17,75 18,75 19,75	18,25
Highclere and White Horse Hill - -	53	33	49,5 49,75	49,5
White Horse Hill and Shotover Hill - -	62	32	3,5 4,5 6,5 7	5,25
White Horse Hill and Brill - - -	86	4	15,75 16 17	16,25

On Scutchamfly Barrow.

White Horse Hill and Shotover Hill - - -	111	47	50	
Shotover Hill and Wendover - - -	34	26	50 50,75 52,75 54,5	52

At Stow on the Wold.

Cleave and Broadway Beacon - - -	54	44	54,5 54,5 57 57	55,75

Between	°	′	″	Mean.
Broadway Beacon and Epwell	72	38	48,5 49 50,5	″ 49,5
Epwell and Brill	60	56	6 6,5	6,25
White Horse Hill and Cleave	109	40	36,25 36,75 37 37,75	37
At Broadway Beacon.				
Epwell and Stow	69	10	30,75 31,5 32,75	31,75
Stow and Cleave	78	53	6 8 9,5	7,75
Cleave and Malvern Hills	60	28	12,5 17,75 18	16
Malvern and Lecky Hills	53	53	19½ 20	19,75
At Epwell.				
Stow and Broadway Beacon	38	10	43,25 43,5 44 44,25 44,5	44
Stow and Brill	86	29	13 13,5 13,75	13,5
Brill and Arbury Hill	85	0	16,5 20,5	18,5
Arbury Hill and Corley	54	55	17,5 19 20,25	18,75
At Corley.				
Bardon Hill and Nuneaton Common	49	54	50,75 53	51,75
Nuneaton and Arbury Hill	110	20	52 52,5 52,75 53	52,75

Between	°	′	″	Mean ″
Arbury Hill and Epwell	35	17	34,75 35,75 36,25 36,75 38 39,25	36,75
Epwell and Broadway Beacon	28	2	46,75 50 53	49,75
Nuneaton and Lecky Hills	133	25	11,5 11,5	11,5
Nuneaton and Station near Birmingham	49	54	50,75 53	52

At Arbury Hill.

	°	′	″	Mean
Quainton and Brill	16	12	37,25 37,5 40,5 42,5 42,75	40
Brill and Epwell	60	35	43 43,25 44,5 45 46,5 48,5 48,5	45,5

Near Brill on the Hill.

	°	′	″	Mean
White Horse Hill and Stow	50	14	44 44,5 44,75	44,5
Nuffield and White Horse Hill	55	7	33 34	33,5
Stow and Epwell	32	34	42,5 43,5 43 43,25	43
Epwell and Arbury Hill	34	23	58,5 58,75	58,5
Arbury Hill and Bow Brickhill	68	20	7,75	
Bow Brickhill and Wendover	57	25	1 2	1,5
Wendover and Shotover Hill	108	5	22 23,5	22,75
Quainton and Wendover	51	34	33,25 32,75	33

Near Wendover.

	°	′	″	Mean
Scutchamfly Barrow and Shotover Hill	28	2	12,75	

Between	°	′	″	Mean.
Brill and Quainton	33	26	48 48 48,25	48″
Brill and Bow Brickhill	80	11	8,25 10,25	9,25
Brill and Shotover Hill	23	23	56,25 58,75	57,5
Bow Brickhill and Stanmore	102	22	29	
Pen Tower and Stanmore	38	13	16,25 19,75	18
Near Quainton.				
Bow Brickhill and Wendover	94	23	49,25 51,25	50,25
Wendover and Brill	94	58	36 38	37
At Bow Brickhill.				
Brill and Arbury Hill	68	22	55,5 55,75 57,5 58,75	56,75
Brill and Wendover	42	23	50,5 51	50,75
Wendover and Kinsworth	46	18	4,25 5,75 9,25 14	8,25
Kinsworth and Quainton	85	9	51,75 53,75	52,75
Kinsworth and Lillyhoe	42	10	33,25 38,5 39	36,75
Kinsworth and Lidlington	80	39	37,25	
Trusler Hill and Lillyhoe	14	54	38,75 43,5 45,5	42,5
Trusler Hill and Arbury Hill	45	49	41,75 44	43
At Kinsworth.				
Brill and Bow Brickhill	62	55	35,25 38,5 39 42	38,75
Quainton and Bow Brickhill	52	17	56,25 57,25 57	56,75

Between	°	′	″	Mean.
Bow Brickhill and Lillyhoe	82	50	26 30 35	″ 30,5
Lillyhoe and Tharfield Tower	12	12	39,75 42	40,75
Tharfield and Station on Gazebo at Berkhamstead	50	2 3	55,5 56 0,5 1	53,25
Stanmore and Berkhamstead	41	15	56,5 57,75	57,25
Bow Brickhill and Stanmore	173	37	43 45	44

Near Lillyhoe.

Bow Brickhill and Kinsworth	54	58	52,5 52,5 52,5 53,75	53
Lidlington and Bow Brickhill	23	59	30 32	31
Bow Brickhill and Trusler Hill	5	52	11,5	
Station on the Ground near Tharfield Tower and Kinsworth	166	4	44,5 48	46,25

At Lidlington.

Kinsworth and Bow Brickhill	68	16	19 22,75 25,25	22,25

At Crouch Hill.

Brill and Epwell	145	23	25,75 27	26,25

At Stanmore.

Wendover and Kinsworth	37	41	39,25 43	41
Pen Tower and Wendover	23	4	47,5 47,5 47,75 49,25 49,25	48,5
Bagshot and Pen Tower	49	32	29,5	
Bagshot Heath and Hanger Hill Tower	59	55	54,25 53,75	54

Between	°	′	″	Mean.
Hampstead Heath and Hanger Hill Tower - -	45	25	51 51,5 51,5 52,75	51,75

On Busby Heath.

Between	°	′	″	Mean.
Wendover and Kinsworth - - -	38	22	5 8,5	6,75

On Bagshot Heath. Station of 1794.

Between	°	′	″	Mean.
Highclere and Nuffield - - -	55	32	25,5 25,75 26,75	26
Nuffield and Pen Tower - - -	48	47	11 12,75 12,75	12,5
Pen Tower and St. Ann's Hill - - -	70	30	37,25 39 40	39,25

ART. 7. *Situations of the Stations.*

Trevose Head. The station on this point of land, which is about four miles from Padstow, in Cornwall, is situated on the southern part of it, and is about forty feet from the declivity. The ground seems a little higher than any other part of the Head.

Cadon Barrow. The station is on the centre of the Barrow; which is a very remarkable one, and well known about the country. It is about two miles from Tintagel, being in a field lying south of the road leading from that town to Camelford.

Brown Willy. The staff is erected on the highest part of this mountain, which is about nine miles southward of Camelford.

St. Stephen's Down. The station is about 150 feet from the eastern part of the building erected on this Down. It lies south-west from the corner of it, and about twenty feet from the road.

Mendip. The station is in a field on the top of the down, being about two miles north of *Shepton Mallet.* The field is next to the road leading from that place to Bristol, and lies west of it: it is also north of the road which goes from Wells to Frome.

This road crosses the former at right angles. The station is 20 feet north of the southern hedge, and about 200 from the eastern one. The ground round the station is rather higher than any other part of the field.

Dundry. The station is on the down, close to, but west of, the town so called. The down is full of holes and pits, from which stones have been taken for the purposes of building. The station, however, may easily be found, as it is situated on a rising which has the appearance of having been a barrow.

Lansdown. This place is well known, and near Bath. The station is on the highest part of the broken ground called CROMWELL's *Camp*, which is near Mr. GRANVILLE's monument.

Farley Down. The station on this Down is 5 feet north of the stone wall, and about 150 feet eastward of the plantation.

Bradley Knoll. This is a remarkable hill, very near Maiden Bradley. The highest part of the hill is towards the west, on which there is a small ring, exhibiting an appearance of a ruined plantation. The station is a few feet to the northward of this ring.

Westbury Down. There are no objects on this Down, of any kind; therefore, the station cannot be found from measurements. It is, however, just above the *White horse* cut out in the side of the hill.

Ash Beacon. This eminence is about four miles north of Sherborne: on the top of it there is a small plantation, round which is a circular wall. The station is 85 feet east of it.

Dundon Beacon. This is an insulated hill, at the eastern extremity of King's Sedgemoor; upon it are the remains of a barrow, probably the site of the ancient beacon. The station is about 4 feet eastward of the small cavity in the centre of it.

Lugsborn Corner, the eastern extremity of King's Sedgemoor. There is a small rivulet, which separates the moor from the cultivated ground on the Somerton side, and, close to a particular part of it, is a passage called *Somerton Gate*. About a quarter of a mile eastward of this entrance, and in the second field, north of the stream, is the station called *Lugsborn Corner*, one of the ends of the base. The spot is 5 feet from the ditch, and 19 from the gateway. There were but three fields in this part of the moor, at the time the base was measured.

Greylock's Foss. This is towards the western extremity of the moor: a causeway leads from *Middlezoy* to *Greinton*, over it. In the second field from the bridge, near the latter, is the other extremity of the base. The station is about 10 feet from the ditch, running parallel to the Foss, and is in the angle formed by the ditch contiguous to the road and the second ditch north of the drain.

Nuffield. The station is in the field opposite to the church: it is in the south-west corner of it, 14 feet from the *stile*, and 10 feet from the hedge.

Scutchamfly. A very remarkable Barrow, on the Berkshire downs, situated near Little Hendred. The station is on the south-west part of it, and can easily be found.

White Horse Hill. This is a well known eminence in Berkshire. The station is on the eastern side of the Saxon work, and on the top of the small parapet surrounding the ditch.

Shotover Hill, near Oxford. The station is 150 feet from the hedge eastward of it, and 60 feet from that southward of it; but, when the traces of our former operations are obliterated, it will be difficult to recover this station.

Stow on the Wold. The station bearing this name, is in a field 2 miles eastward of the town: it lies on the north side of the road leading from Stow to Burford, and may be easily distinguished, being that particular field which affords the most commanding view. The station is 32 feet west of the corner of the hedge which forms a right angle with another abruptly running out: it is also 279 feet from the ridge which divides the field.

Broadway Beacon. This is a very high and remarkable spot, near the village of Broadway, in Gloucestershire. The station is about 20 feet south-east of the foundation of a building proposed to be erected by the Earl of COVENTRY.

Corley, a village in Warwickshire. The station is in the second field eastward of the church, being 180 feet from the eastern hedge, and 230 feet from the stile in the corner of it.

Epwell, a village in Oxfordshire. The station is on the apex of the hill, and may easily be found, by measuring 17 feet from the stile, and 14 feet from the hedge which runs across the hill. N. B. The station is west of the hedge.

Brill on the Hill, Buckinghamshire. The station is on *Muzzle Hill*, near the town. There is but one field on this hill: it is on the highest part of it. The station is situated in the centre of the field, and in the middle of a rising, once the site of a windmill.

Arbury Hill. This hill is still surrounded with the remains of an ancient fortification. The station is on the north-west corner of it, and near the brow, but cannot be easily found, from the want of proper objects to which measurements may be made.

Wendover, Buckinghamshire. The station is on the down south of the town, and contiguous to the village of Ellesborough. A road from Wendover, to Sir JOHN RUSSELL's seat, Checquers, runs over the down: but, as there are no marks on it, its precise situation cannot be easily pointed out by measurement. It may, however, be observed, that it is 14 feet southwards, from the decayed parapet on the top of the hill.

Quainton, Buckinghamshire. The station is on the high ground, north of this town. It cannot very easily be found, because the hill is destitute of objects; yet it may, probably, be discovered, by looking for it on the *green ridge* which divides the land: it is in the middle of that boundary, and about 200 feet westward of the pathway.

Kinsworth, a village near Dunstable. The station is on the summit of a hill, about half a mile north of the village. A hedge runs across the hill, from which the station is 40 feet north-west: it is likewise *close* to the road.

Lillyhoe, Hertfordshire. The station is on a commanding eminence, having the *Icknield way* at the foot of it. There are no objects on this hill, therefore the precise situation cannot be pointed out by means of measurement: it is towards the north-west corner of the hill.

Stanmore. This station is on the southern extremity of the range above the town: it is near the trees, and a little to the westward of the broken ground.

Busby Heath, near Stanmore. The station cannot be easily found: it is about 1000 feet from the road, but there are no objects near enough to determine it by measurement.

Wrotham. This station is 205½ feet north-east of the old station: it may be easily found, with the assistance of a theodolite, Severndroog Tower making an angle of 94° 19′ with the new station.

Gravesend. The station is on Windmill Hill, and on the western side of it: it is about 50 feet south of the stile, and near the brow.

Gad's Hill, Kent. The station is very easily found, being in the middle of the *tumulus.*

Sheppey, Isle of. The station is on the bare hill, westward of, and contiguous to, the high range: it cannot be found through means of measurement.

Hampstead. The station is on the heath, but cannot easily be found, on account of the rugged and broken ground which surrounds it: it is situated 40 feet from the road, and among the sand holes.

Langdon Hill, Essex. The station is in the middle of the field on the top of this hill: it is about 400 feet from either of the stiles.

Hadleigh. The station is on a remarkable hill, in shape very like a barrow, and is about a mile south-west of the town.

Southend. The station is in the second field westward from the terrace: it cannot be easily found.

Interior Stations.

Hope's Nose, the north projecting point of Torbay. The only spot fit for a station in this part is the one chosen: it can easily be found, for it is the high and bare rising, just above the Nose.

Ball's Obelisk. This object is on the eastern part of Great Haldon, in Devonshire. The station can be easily found, for it is close to the gate of the inclosure, and on the only spot not covered with heath.

Evercrutch, in Somersetshire. The hill on which the station is, commands an extensive view, and is not far from the town of Evercrutch. Bruton is also near it. The station is in the middle of the flat place on the top of the hill.

Crouch Hill, near Banbury, in Oxfordshire. The hill is well known, and the station easily found; for the apex of the hill appears as if it were truncated, and in the middle of the smooth part is the station.

Cumner Hill, near Oxford. The station is about 130 feet westward from the centre of the clump of trees.

Whiteham Hill, Oxfordshire. There are a few trees contiguous to the station, which bear eastward from it, and are about 80 feet distant. The station is on the highest and smoothest part of the hill.

Lidlington, a village near Ampthill in Bedfordshire. This station can easily be found, for a tumulus, whose centre is the station, has been erected, to render it conspicuous.

Trusler Hill, in Woburn Park. The station is on a tumulus likewise; and can be found without any difficulty.

Stations in Essex, Suffolk, and Hertfordshire.

Prittlewell Steeple.

Rayleigh Steeple. The station is in the north-east corner, 20 inches from the north parapet, and 4 feet from the eastern one.

Danbury Steeple. The instrument was placed in the four angles of the Steeple, as circumstances rendered it necessary. The points are readily found, as there is scarcely room in the corners to place an instrument. Stations were also selected on the following Steeples, &c.

Canewden Steeple.
Frierning St.
Tillingham St.
Thorp St.
Stoke St.
Dover Court St.
Peldon St.
West Mersea St.
Colchester, St. Mary's Staircase.
Tattingstone St.
Rushmere St.
Great Tey St.
St. Osyth Priory, Flagstaff.
Shoebury Ness, Staff.
Little Bentley St.
Woodbridge St.
Butely St.
Otley St.
Henley St.
Falkenham St.
Copdock St.

Naughton St.
Lavenham St.
Bulmer St.
Glemsford St.
Toppesfield St.
Twinestead St.
Southweald St.
Pleshley St.
High Easter St.
HatfieldBroad Oak St.
Beauchamp Roding St.
Hornchurch St.
Naseing St.
Henham on the Mount St.
Thorley St.
Albury St.
Elmdon St.
Rickling St.
Thaxted St.
Balsham St.
Westham St.
Barking, Staircase.
Berkhampstead, Gazebo.
Gallywood Common.
Purfleet Cliff.
Babraham Mount.
Epping Mill, Base.
Brentwood Spire, surveyed round.

Stations in Kent.

Frant Steeple. Station of 1787.
Botley Hill. Do.
Chiddingstone St.
Mount Sion.
East Peckham St.
Tudely St.
Seal Chart.
Tunbridge St.
Oxford Mount.
Silverden Farm.
Well Hill.
Crayford St.
Ash St.
North Fleet St.
Stockbury St.
Hernhill St.

The stations chosen for the survey of Essex, and parts of the adjoining counties, as also for completing the survey of Kent, are mostly towers, as may be seen from the above. When the tops of the towers have been smooth and even, the stations were always in the centres of them; but, when they were covered with roofs, or had spires upon them, stations were chosen in the most convenient places, and staffs always erected. I have omitted giving the measurements by which the stations may be exactly found, Rayleigh and Prittlewell excepted, in order to avoid swelling this article to an inconvenient length.

ART. VIII. *Particulars relating to the Base on King's Sedgemoor, and the Reduction of that Base.* Plate XXVIII.

Comparisons of the Chains.

As the chains, after the measurement on Salisbury Plain, were oiled, and laid up in the Tower, no apprehensions were entertained that either of them was elongated by the rusting of the joints. It was, however, our wish to have compared them with each other, previous to the commencement of this operation, and attempts were made, but rendered unsatisfactory, from the want of sufficient firmness in the soil. It was not till we arrived at the 70th chain, that a good opportunity presented itself: the measuring chain A, was then compared with the standard B, and found to be thirteen divisions of the micrometer head, attached to the brass scale, in excess. In these trials, the temperature remained constant; the mercury in FAHRENHEIT'S thermometer being at $66\frac{1}{2}°$.

The 50-feet chain, spoken of in a former article, came from the hands of Mr. RAMSDEN without being very accurately measured; therefore it now became proper to ascertain its length, by means of the standard chain. This was accordingly done at the present time; when B was found to exceed twice the length of the 50-feet chain, by 14 divisions of the micrometer screw; the thermometer, at the time of trial, standing at $69\frac{1}{2}°$.

At the conclusion of the measurement, the chains were again compared, when the working chain A, was found to exceed the standard, $17\frac{1}{4}$ divisions on the micrometer head: this was after 273 chains were measured. Now, when 70 chains only had been measured, the difference between A and B was 13 of those divisions; consequently $17\frac{1}{4} - 13, = 4\frac{1}{4}$ divisions, was the wear of B, in measuring 203 chains. Therefore, the whole wear is found by this proportion, *viz.* $203 : 4\frac{1}{4} :: 273 : 5{,}223$ divisions, $= \frac{2}{100}$ of an inch; which very inconsiderable quantity, like the wear on Salisbury Plain, no doubt, arose from the pivots and pivot holes of the joints being polished by continual use. This supposition seems just; as the wear of the chain, after the measurement on Hounslow Heath, was found to be much greater.

The length of the chain A, as well as that of the standard B, was accurately ascertained by Mr. Ramsden, in the year 1793, as particularly shewn in the Philosophical Transactions for 1795. In the temperature of 54°, A was found to exceed 100 feet, $\frac{11425}{100000}$ of an inch; therefore, adding the wear which took place on Salisbury Plain, *viz.* $\frac{1}{260}$ part of an inch, we get the length of A at the commencement of the measurement on Sedgemoor = 100,01009 feet.

From repeated trials, as before observed, the standard B was found to exceed the length of twice that of the new fifty-feet chain, 14 divisions of the micrometer head; and, *after* the measurement, the same chain fell short of A, $17\frac{1}{4}$ of those divisions: hence, A exceeds twice the length of the 50-feet chain, $31\frac{1}{4}$ divisions. Therefore the length of the short chain, in the temperature of 54°, may be taken at 50,00075 feet.

ART. IX. *Table of the Measurement of the Base of Verification on King's Sedgemoor.*

Days.	Spaces measured. Yards.	Mean temp. by 15 therm.	Days.	Spaces measured. Yards.	Mean temp. by 15 therm.	Days.	Spaces measured. Yards.	Mean temp. by 15 therm.
July	100	69,7		3200	79.27	6	6300	92,26
	200	65,56		3300	79.96		6400	86,73
11	300	62,73	25	3400	62,06		6500	68,30
	400	67,40		3500	65.90	7	6600	82,06
	500	64,10	26	3600	67,63		6700	91,06
12	600	65,30		3700	65,83		6800	89,76
	700	73.40	27	3800	67,72		6900	93.43
	800	69,36		3900	75.53	8	7000	75.94
	900	68,06		4000	71,40		7100	81,57
13	1000	66,05		4100	71,23		7200	81,93
	1100	70,30		4200	67,14		7300	79.36
	1200	69,33	31	4300	66,56		7400	68,20
	1300	62,83	Aug. 1	4400	71,16	9	7500	78,18
14	1400	63,93	2	4500	64,60		7600	76,50
	1500	61,40		4600	65,16		7700	71,26
	1600	57,03		4700	68,16		7800	72,13
16	1700	66,36		4800	70,16		7900	70,8
	1800	65,80		4900	76,23	13	8000	71,5
	1900	71,03		5000	70,66		8100	8,4
17	2000	75.70		5100	64,23		8200	84,53
	2100	80,43	3	5200	64,46		8300	76,13
	2200	77.53		5300	63,96		8400	69,56
18	2300	65,96		5400	63,86		8500	66,63
	2400	69,79		5500	67,13	14	8600	85.53
	2500	69,56	4	5600	78,53		8700	83,73
	2600	68,16		5700	73.84		8800	85,87
19	2700	68,19		5800	69,83		8900	78,46
	2800	72,66		5900	65,86		9000	78,36
	2900	69,23		6000	61,50	15	9100	73.77
21	3000	70,76		6100	76,46	16	9225.4943	63,00
	3100	79,68		6200	84,26			

ART. x. *Reduction of the Base.*

	Feet.
The overplus of the 273d chain was measured by Mr. RAMSDEN, and found to be 23,517 feet; wherefore, the apparent length of the base was -	27676,4830
From the measurement in the Riding-house of his Grace the Duke of MARLBOROUGH, the chain A was found to exceed 100 feet, in the temperature of 54°, 0,11425 parts of an inch; to which, adding the wear by the measurement on Salisbury Plain, *viz.* $\frac{1}{260}$, and also *half* the wear by the measurement of this base, *viz.* $\frac{1}{100}$ part of an inch, we get $\frac{0,1191}{12}$ for the excess of the chain's length above 100 feet; therefore, $\frac{0,1191}{12} \times 272,8 = 2,7075$ feet; which add - - - - -	$+2,7075$
The sum of all the degrees shewn by the thermometer was 98511; wherefore, $\overline{\frac{98511}{5} - 54^\circ} \times 272,8 \times \frac{0,0075}{12} = 3,1069$ feet; which also add -	$+3,1069$
Again, from the comparison of the 50-feet chain with the standard B, it appeared that the excess above 50 feet, in the temperature of 54°, was 0,09075 parts of an inch; therefore, $\frac{0,09075}{12} \times 8 = 0,0605$ parts of a foot. This likewise add -	$+0,0605$
The sum of all the degrees shewn by the thermometers placed by the sides of the 50-feet chain, was 1372; therefore $\overline{\frac{1372}{5} - 54^\circ} \times 4 \times \frac{,0075}{12} = 0,0365$ parts of a foot: and this add - -	$+0,0365$
	27682,3944

27682,3944

And, for the reduction of the base to the temperature of 62°, *viz.* for 8° on the brass scale, we have $\frac{0{,}01237 \times 272{,}8 \times 8^\circ}{12} = 2{,}2497$ feet; which subtract —2,2497

Therefore, the length of the base is - - - feet 27680,1447 which, neglecting decimals, may be taken at 27680 feet.

As to the probable error of the above conclusion, I know not how to form a just opinion. On ground sufficiently hard, and otherwise favourable, I think a base of 5 miles might be measured so accurately, as to afford a result not differing from the truth more than three inches: but, on this occasion, I should not suppose the error can be less than six, nor more than nine inches. Motives for adopting this supposition, have been related in a foregoing article.

ART. XI. *Calculation of the Sides of certain principal Triangles in Cornwall and Devonshire.* Plate XXVII.

Distance from Hensbarrow to St. Agnes Beacon, 97084,8 Feet. Phil. Trans. 1797. p. 461.

No. of triangles	Names of stations.	Observed angles.	Diff.	Spherical excess.	Error.	Angles corrected for calculation.	Distances.
		° ′ ″	″	″	″	° ′ ″	Feet.
1.	St. Agnes Beacon	47 10 0,75	—0,15			47 10 3,25	
	Hensbarrow - -	67 6 13,25	—0,58			67 6 13	
	Trevose Head -	65 43 47	—0,57			65 43 43,75	
		180 0 1		1,31	—0,31		
	Trevose Head from St. Agnes Beacon -						98108,1
	Trevose Head from Hensbarrow - -						78099,9

Distance from Hensbarrow to Bodmin Down, 47337,2 Feet. Phil. Trans. 1797. p. 460.

No. of triangles	Names of stations.	Observed angles.	Diff.	Spherical excess.	Error.	Angles corrected for calculation.	Distances.
		° ′ ″	″	″	″	° ′ ″	Feet.
II.	Hensbarrow - -	77 20 18,5	−0,30			77 20 17,5	
	Bodmin Down -	68 21 58,25	−0,32			68 21 57,25	
	Trevose Head -	34 17 45,5	−0,23			34 17 45,25	
		180 0 2,25		0,86	+1,39		
	Trevose Head from Bodmin Down - -						81967,6
	Hensbarrow - -						78093

Mean distance from Hensbarrow to Trevose Head, 78096,4 feet.

III.	Trevose Head -	42 33 52	−0,32			42 33 51,25	
	Bodmin Down -	71 55 27	−0,43			71 55 26,75	
	Cadon Barrow -	. . .				65 30 42,0	
	Cadon Barrow from Trevose Head - -						85625
	Bodmin Down - -						60925
IV.	Bodmin Down -	30 58 13	−0,05			30 58 12,75	
	Cadon Barrow - -	43 49 50,5	−0,04			43 49 50	
	Brown Willy - -	. . .				105 11 57,25	
	Brown Willy from Bodmin Down - -						43722
	Cadon Barrow - -						32488

Distance from Carraton Hill to Maker Heights, 82600,3 feet. Phil. Trans. 1797. p. 458.

V.	Carraton Hill - -	74 5 22,5	−0,60			74 5 21,75	
	Maker Heights -	53 4 29	−0,48			53 4 28,75	
	Black Down - -	52 50 9,75	−0,48			52 50 9,5	
		180 0 1,25		1,57	−0,32		
	Black Down from Maker Heights - -						99680
	Carraton Hill - -						82860,4

27682,3944

And, for the reduction of the base to the temperature of 62°, *viz.* for 8° on the brass scale, we have $\frac{0,01237 \times 272,8 \times 8^{\circ}}{12} = 2,2497$ feet; which subtract —2,2497

Therefore, the length of the base is - - - feet 27680,1447 which, neglecting decimals, may be taken at 27680 feet.

As to the probable error of the above conclusion, I know not how to form a just opinion. On ground sufficiently hard, and otherwise favourable, I think a base of 5 miles might be measured so accurately, as to afford a result not differing from the truth more than three inches: but, on this occasion, I should not suppose the error can be less than six, nor more than nine inches. Motives for adopting this supposition, have been related in a foregoing article.

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		° ′ ″	″	″	″	° ′ ″	Feet.
1.	St. Agnes Beacon	47 10 0,75	—0,15			47 10 3,25	
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	Trevose Head -	65 43 47	—0,57			65 43 43,75	
		180 0 1		1,31	—0,31		
	Trevose Head from St. Agnes Beacon -						98108,1
	Trevose Head from Hensbarrow - - -						78099,9

Distance from Hensbarrow to Bodmin Down, 47337,2 Feet. Phil. Trans. 1797. p. 460.

No. of triangles	Names of stations.	Observed angles.	Diff.	Spherical excess.	Error.	Angles corrected for calculation.	Distances.
		° ′ ″	″	″	″	° ′ ″	Feet.
II.	Hensbarrow - -	77 20 18,5	—0,30			77 20 17,5	
	Bodmin Down -	68 21 58,25	—0,32			68 21 57,25	
	Trevose Head -	34 17 45,5	—0,23			34 17 45,25	
		180 0 2,25		0,86	+1,39		
	Trevose Head from Bodmin Down - -						81967,6
	Trevose Head from Hensbarrow - -						78093

Mean distance from Hensbarrow to Trevose Head, 78096,4 feet.

III.	Trevose Head -	42 33 52	—0,32			42 33 51,25	
	Bodmin Down -	71 55 27	—0,43			71 55 26,75	
	Cadon Barrow -	. . .				65 30 42,0	
	Cadon Barrow from Trevose Head - -						85625
	Cadon Barrow from Bodmin Down - -						60925
IV.	Bodmin Down -	30 58 13	—0,05			30 58 12,75	
	Cadon Barrow - -	43 49 50,5	—0,04			43 49 50	
	Brown Willy - -	. . .				105 11 57,25	
	Brown Willy from Bodmin Down - -						43722
	Brown Willy from Cadon Barrow - -						32488

Distance from Carraton Hill to Maker Heights, 82600,3 feet. Phil. Trans. 1797. p. 458.

V.	Carraton Hill - -	74 5 22,5	—0,60			74 5 21,75	
	Maker Heights -	53 4 29	—0,48			53 4 28,75	
	Black Down - -	52 50 9,75	—0,48			52 50 9,5	
		180 0 1,25		1,57	—0,32		
	Black Down from Maker Heights - -						99680
	Black Down from Carraton Hill - -						82860,4

No. of triangles	Names of stations.	Observed angles.	Diff.	Spherical excess.	Error.	Angles corrected for calculation.	Distances.
		° ′ ″	″	″	″	° ′ ″	Feet.
VI.	Carraton Hill - -	48 57 8,25	−0,24			48 57 9,25	
	Black Down - -	39 44 39	−0,22			39 44 38,5	
	St. Stephen's Down	91 18 12,75				91 18 12,25	
		180 0 0		0,89	−0,89		
	St. Stephen's Down from Carraton Hill - -						52991,3
	St. Stephen's Down from Black Down - -						62506,7

Distance from Carraton Hill to Kit Hill, 33427 feet. Phil. Trans. 1797. p. 459.

VII.	Carraton Hill - -	70 15 32	−0,14			70 15 32,25	
	St, Stephen's Down	37 1 56	−0,11			37 1 55,75	
	Kit Hill - -	. . .				72 42 32	
	St. Stephen's Down from Carraton Hill - -						52994
	St. Stephen's Down from Kit Hill - - -						52240,4

Mean distance from St. Stephen's Down to Carraton Hill, 52292,7 feet.

VIII.	St. Stephen's Down	54 16 13	−0,19			54 16 12,5	
	Black Down - -	52 57 37	−0,19			52 57 36,5	
	Kit Hill - -	. . .				72 46 11	
	Black Down from Kit Hill - - -						53128
	Black Down from St. Stephen's Down -						62509,2

Hence the mean distance from Black Down to St. Stephen's Down, is 62508 feet.

In the third triangle, the angle at Cadon Barrow is supplementary. When the observations were made at that station, a direction-post at Bodmin Down was mistaken for the staff, (to which it was similar in shape,) erected at no great distance from it. This error was not detected till long after: and, although it has been a maxim to which we have generally adhered, of observing all the angles of each triangle, yet, for the reasons assigned in the preface, I have chosen to depart from it on the present occasion. In another principal triangle, the angle at Brown Willy is also supplementary: it has already been mentioned, that an instrument cannot be got on the top of it. As to the angles at Kit Hill, in the two last triangles, being inferred ones, it may be proper to mention, that Black Down was chosen for a station, after the observations were made at the former. To have visited Kit Hill a second time would have been unnecessary, because there are not any distances, except to interior objects, which depend upon those triangles.

ART. XII. *Calculation of the Sides of a Set of principal Triangles, carried on from the Side which joins the Stations on Beacon Hill, near Amesbury, and Wingreen Hill, near Shaftsbury, towards the Base of Verification on King's Sedgemoor.* Plate XXIX.

Distance from Beacon Hill to Wingreen Hill, 114522,4 Feet. Phil. Trans. 1795. p. 501.

No. of triangles	Names of stations.	Observed angles.	Diff.	Spherical excess.	Error.	Angles corrected for calculation.	Distances.
		° ′ ″	″	″	″	° ′ ″	Feet.
IX.	Wingreen Hill -	89 57 37,75	−0,97			89 57 37	
	Beacon Hill -	32 11 43,25	−0,48			32 11 43	
	Bradley Knoll	57 50 38,25	−0,48			57 50 40	
		179 59 59,25		1,93	−2,68		
	Bradley Knoll from Wingreen						72074
	Bradley Knoll from Beacon Hill -						135272,3
X.	Bradley Knoll -	40 43 52	−0,26			40 43 51,5	
	Wingreen -	96 20 37	−0,65			96 20 36,25	
	Bull Barrow -	42 55 32,75	−0,25			42 55 32,25	
		180 0 1,75		1,16	+0,55		
	Bull Barrow from Bradley Knoll -						105180
	Bull Barrow from Wingreen - -						69053,6

In the Philosophical Transactions for 1797, p. 455, the distance from Bull Barrow to Wingreen is said to be 69058, being 4½ feet greater than the above conclusion.

No. of triangles.	Names of stations.	Observed angles.	Diff.	Spherical excess.	Error.	Angles corrected for calculation.	Distances.
		° ′ ″	″	″	″	° ′ ″	Feet.
XI.	Bull Barrow -	40 38 47,75	−0,28			40 38 45,25	
	Bradley Knoll	45 43 3,5	−0,28			45 43 3,25	
	Ash Beacon -	93 38 12,5	−0,65			93 38 11,5	
		180 0 3,75		1,25	+2,50		
	Ash Beacon from Bradley Knoll -						68650,6
	Ash Beacon from Bull Barrow -						75451
XII.	Beacon Hill -	23 4 15	−0,08			23 4 14,75	
	Bradley Knoll	42 43 29,75	+0,07			42 43 28,25	
	Westbury Down	114 12 18,5	−0,07			114 12 17	
		180 0 3,25		1,17	+2,08		
	Westbury Down from Beacon Hill -						100625,1
	Westbury Down from Bradley Knoll -						58118,2
XIII.	Westbury Down	40 48 1,75	−0,12			40 48 1,75	
	Bradley Knoll -	101 23 59	−0,48			101 23 59,75	
	Mendip Hills -	37 47 58,5	−0,16			37 47 58,5	
		179 59 59,25		0,77	−1,52		
	Mendip Hills from Westbury Down -						92954,0
	Mendip Hills from Bradley Knoll -						61961,1

Base of verification.—Greylock's Foss to Lugshorn Corner, 27680 feet.

No. of triangles.	Names of stations.	Observed angles.	Diff.	Spherical excess.	Error.	Angles corrected for calculation.	Distances.
XIV.	Lugshorn Corner	107 44 31				107 44 31	
	Greylock's Foss -	8 30 0				8 30 0	
	Dundon Beacon -	63 45 29				63 45 29	
		180 0 0			0		
	Dundon Beacon from Lugshorn Corner -						4561,5
	Dundon Beacon from Greylock's Foss						29393

No. of triangles.	Names of stations.	Observed angles.	Diff.	Spherical excess.	Error.	Angles corrected for calculation.	Distances.
		° ′ ″	″	″	″	° ′ ″	Feet.
XV.	Greylock's Foss -	105 40 0,25				105 40 0,5	
	Moor Lynch -	59 58 14				59 58 14,5	
	Dundon -	14 21 44,75				14 21 45	
		179 59 59			−1,0		
	Moor Lynch from Greylock's Foss -						8421,5
	Moor Lynch from Dundon Beacon -						32688,7
XVI.	Lugshorn Corner -	13 51 59				13 51 58,75	
	Greylock's Foss -	114 9 59				114 9 58,5	
	Moor Lynch -	51 58 3,25				51 58 2,75	
		180 0 1,25			+1,25		
	Moor Lynch from Lugshorn Corner -						32061,3
	Moor Lynch from Greylock's Foss -						8421,8
XVII.	Lugshorn Corner -	93 52 33,75				93 52 34,25	
	Moor Lynch -	8 0 10,25				8 0 10,75	
	Dundon Beacon -	78 7 14,5				78 7 15	
		179 59 58,5			−1,5		
	Dundon Beacon from Lugshorn Corner -						4561,5
	Dundon Beacon from Moor Lynch -						32689,0

Hence the mean distance from Moor Lynch to Dundon Beacon is 32688,85 feet.

No. of triangles.	Names of stations.	Observed angles.	Diff.	Spherical excess.	Error.	Angles corrected for calculation.	Distances.
XVIII.	Moor Lynch -	54 38 50	−0,07			54 38 49,5	
	Dundon Beacon -	101 22 54,5	−0,32			101 22 53,75	
	Mendip Hills -	23 58 17	−0,10			23 58 16,75	
		180 0 1,5		0,5	+1,0		
	Mendip Hills from Moor Lynch - -						78876,8
	Mendip Hills from Dundon Beacon -						65622,7

No. of triangles	Names of stations.	Observed angles.	Diff.	Spherical excess.	Error.	Angles corrected for calculation.	Distances.
		° ′ ″	″	″	″	° ′ ″	Feet.
XIX.	Moor Lynch -	54 3 22,5	—0,42			54 3 22	
	Mendip Hills -	69 26 48,25	—0,49			69 26 47	
	Ash Beacon -	56 29 51,5	—0,42			56 29 51	
		180 0 2,25		1,33	+0,92		
	Ash Beacon from { Moor Lynch - -						88571
	Mendip Hills -						76851
XX.	Mendip Hills -	58 16 22	—0,30			58 16 21,5	
	Ash Beacon -	50 8 45,5	—0,28			50 8 45,25	
	Bradley Knoll -	71 34 55	—0,36			71 34 54,25	
		180 0 2,5		0,95	+1,55		
	Bradley Knoll from { Mendip Hills -						61963,5
	Ash Beacon - -						68653,6

The distance from Bradley Knoll to the station on Mendip Hills, and also to that on Ash Beacon, is given in the preceding triangles, independent of the above values. The first is 61961,1, and the second 68650,6 feet: these distances have their origin in the base on Salisbury Plain. The other distances are 61963,5, and 68653,6 feet; and these depend on the base of verification on King's Sedgemoor. There is, therefore, a difference of $2\frac{4}{10}$ feet between the values of one distance, (12 miles nearly,) and 3 feet between those of the other, which is about 13 miles in length. If the computations had been carried on from one base to another, the difference between the measured base on Sedgemoor and the computed base, would have appeared to be *one foot nearly*. I have already delivered it as my opinion, that an error of nine inches may exist in the new base: therefore, these results must be considered as satisfactory enough. A different correction of the observed angles, or another selection of the angles themselves, might afford a closer agreement; but I can see no just reason for making any alterations in one or the other. I shall now take the means of the distances, as derived from both bases, and consider 68652,2 feet as the true distance from Ash Beacon to Bradley Knoll; and 61962,3 feet for that between Bradley Knoll and the station on Mendip Hills.

In one of the foregoing triangles, (Bull Barrow, Bradley Knoll, and Ash Beacon,) the distance between Ash Beacon and Bull Barrow is found to be 75451 feet. If the *mean distance* between Bradley Knoll and Ash Beacon, *viz.* 61962,3 feet, be now used, 75452,7 feet becomes the distance between those stations; and this I shall use, in computing the sides of the two triangles which immediately follow.

No. of triangles	Names of stations.	Observed angles.	Diff.	Spherical excess.	Error.	Angles corrected for calculation.	Distances.
		° ′ ″	″	″	″	° ′ ″	Feet.
XXI.	Ash Beacon -	34 18 56,25	−0,14			34 18 55,75	
	Bull Barrow -	51 26 42	−0,13			51 26 41,75	
	Mintern - -	94 14 23	−0,32			94 14 22,5	
		180 0 1,25		0,59	+0,66		
	Mintern from { Ash Beacon - -						59166,6
	Mintern from { Bull Barrow -						42653,7
XXII.	Pilsden - -	35 3 1	−0,24			35 3 0,75	
	Ash Beacon -	49 21 38,25	−0,24			49 21 38	
	Mintern -	95 35 22	−0,60			95 35 21,25	
		180 0 1,25		1,08	+0,17		
	Pilsden from { Ash Beacon - -						102535
	Pilsden from { Mintern - -						78177,6

In our last account, (see Phil. Trans. 1797. p. 455 and 456,) the distance from Bull Barrow to Mintern was found to be 42653,4 feet; and the distance from Pilsden to Mintern 78177 feet. The distances derived from the above triangles are very nearly the same; a difference of a few inches only existing between them.

No. of triangles	Names of stations.	Observed angles.	Diff.	Spherical excess.	Error.	Angles corrected for calculation.	Distances.
		° ′ ″	″	″	″	° ′ ″	Feet.
XXIII.	Moor Lynch -	57 19 3,5	−0,64			57 19 2,5	
	Ash Beacon -	76 2 36,5	−0,39			76 2 36	
	Pilsden - -	. . .				46 38 21,5	
		Pilsden from Moor Lynch - -					118230

But Pilsden was also observed from Dundon Beacon; from which, and the angle observed at Moor Lynch, between Dundon Beacon and Pilsden, results the following triangle.

XXIV.	Moor Lynch - -	56 43 36,75	+0,03			56 43 36,5	
	Dundon Beacon -	108 1 52	−0,64			108 1 51,75	
	Pilsden - -	. . .				15 14 31,75	
		Pilsden from Moor Lynch - - - -					118233,6

Hence, the mean distance from Moor Lynch to Pilsden is 118231,8 feet; and this is the side from which the series about to be carried on, for the survey of the north of Devonshire, is to originate.

In the triangle formed by the stations on Mendip Hills, Bradley Knoll, and Westbury Down, the distance between the first and last is 92954,0 feet; but, computing with the mean distance from Mendip to Bradley Knoll, (61962,3 feet,) as found from both bases, the distance from Mendip to Westbury Down proves to be 92955,9 feet; which distance is used in the remaining principal triangles in this quarter.

XXV.	Farley Down - -	77 21 53,75	−0,44			77 21 52.75	
	Westbury Down -	63 42 51,25	−0,34			63 42 49.75	
	Mendip Hills -	38 55 17,5	−0,30			38 55 17,5	
		180 0 2,5		1,10	+1,40		
		Mendip from Farley Down - - -					85412,2
		Mendip from Westbury Down - -					92955,9

No. of triangles.	Names of stations.	Observed angles	Diff.	Spherical excess.	Error.	Angles corrected for calculation.	Distances.
		° ′ ″	″	″	″	° ′ ″	Feet.
XXVI.	Mendip - -	60 36 15,5	−0,40			60 36 15	
	Dundry - -	69 52 22	−0,44			69 52 22	
	Farley Down -	49 31 23,5	−0,37			49 31 23	
		180 0 1		1,21	−0,21		
	Dundry from { Farley Down - - -						79255,3
	Mendip - - -						69196
XXVII.	Mendip - -	41 3 58,5	−0,25			41 3 58,25	
	Dundry - -	83 34 18	−0,40			83 34 17,5	
	Lansdown - -	. . .				55 21 44,25	
	Lansdown from { Mendip - - -						83573,2
	Dundry - - -						55249,2
XXVIII.	Dundry - -	13 41 56,25	−0,09			13 41 56	
	Farley Down -	27 5 27,5	−0,11			27 5 27,25	
	Lansdown - -	. . .				139 12 36,75	
	Lansdown from { Farley Down - -						28730,4
	Dundry - - -						55248,7

Wherefore, the mean distance from Dundry to Lansdown is 52248,9 feet.

ART. XIII. *Calculation of the sides of certain principal Triangles, carried on from the side Bagshot Heath and Highclere, towards the north.* Plate XXXI.

Distance from Bagshot Heath to Highclere, 142952,6 feet. Phil. Trans. 1795. p. 496.

No. of triangles.	Names of stations.	Observed angles	Diff.	Spherical excess.	Error.	Angles corrected for calculation.	Distances.
XXIX.	Bagshot Heath -	55 32 26	−0,89			55 32 25,25	
	Highclere -	46 10 18,25	−0,83			46 10 17,75	
	Nuffield - -	78 17 18,25	−1,20			78 17 17	
		180 0 2,5		2,94	−0,43		
	Nuffield from { Bagshot Heath - -						105321,2
	Highclere - -						120374

No. of triangles.	Names of stations.	Observed angles.	Diff.	Spherical excess.	Error.	Angles corrected for calculation.	Distances.
		° ′ ″	″	″	″	° ′ ″	Feet.
XXX.	White Horse Hill	63 7 53,25	−0,94			63 7 53,5	
	Highclere - -	63 18 16,75	−0,94			63 18 17	
	Nuffield - -	53 33 49,5	−0,86			63 33 49,5	
		179 59 59,5		2,74	−3,24		
	White Horse Hill from Nuffield - -						120557,7
	White Horse Hill from Highclere - -						108563,1

Distance from Beacon Hill to Highclere, 98694,4 feet. Phil. Trans. 1795. p. 497.

XXXI.	Beacon Hill - -	17 42 38,5	−0,12			17 42 38,25	
	Highclere - -	56 0 29,75	+0,08			56 0 29,25	
	Inkpin Hill - -	106 16 53,25	−0,47			106 16 52,5	
		180 0 1,5		0,50	+1,0		
	Inkpin Hill from Highclere - -						31278,8
	Inkpin Hill from Beacon Hill - -						85247,9
XXXII.	Highclere - -	34 27 50,75	+0,38			34 27 50,75	
	Inkpin Hill -	133 27 57,5	−0,91			133 27 58	
	White Horse Hill	12 4 11,5	+0,04			12 4 11,25	
		179 59 59,75		0,49	−1,24		
	White Horse Hill from Highclere - -						108565,5
	White Horse Hill from Inkpin - - -						84647,1

In the following computations, I shall use 120557,7 feet for the distance between White Horse Hill and Nuffield: this is derived from the base on Hounslow Heath. By the last triangle, White Horse Hill, from Highclere, is distant 108565,5 feet; which is computed from the base on Salisbury Plain. The distance between those stations, found by the second of the above triangles, is 108563,1 feet. Therefore, whether the distance between White Horse Hill and Nuffield be founded on the base measured on Salisbury Plain, or Hounslow Heath, nearly the same conclusion is derived: the difference will not amount to four feet; a small quantity in a side of three-and-twenty miles. I shall, however, use 120557,7, because I think it the most accurate determination.

No. of triangles.	Names of stations.	Observed angles.	Diff.	Spherical excess.	Error.	Angles corrected for calculation.	Distances.
		° ′ ″	″	″	″	° ′ ″	Feet
XXXIII.	White Horse Hill	38 48 13,25	−0,67			38 48 12,5	
	Nuffield	86 4 16,25	−1,21			86 4 15	
	Brill	55 7 33,5	−0,71			55 7 32,5	
		180 0 3		2,6	+0,4		
	Brill from White Horse Hill						146603,2
	Brill from Nuffield						92085,5
XXXIV.	Brill	50 14 44,5	−1,18			50 14 45	
	White Horse Hill	64 45 43,75	−1,34			64 45 42,5	
	Stow on the Wold	64 59 32	−1,35			64 59 45	
		180 0 0,25		3,88	−3,63		
	Stow from White Horse Hill						124365,6
	Stow from Brill						146326,3
XXXV.	Brill	32 34 43	−0,61			32 34 42,25	
	Stow	60 56 6,25	−0,64			60 56 5,5	
	Epwell	86 29 13,5	−1,11			86 29 12,25	
		180 0 2,75		2,37	+0,38		
	Epwell from Stow						78938,2
	Epwell from Brill						128140
XXXVI.	Epwell	38 10 44	−0,25			38 10 42,75	
	Stow	72 38 49,5	−0,34			72 38 47,5	
	Broadway Beacon	69 10 31,75	−0,32			69 10 29,75	
		180 0 5,25		0,92	+4,33		
	Broadway Beacon from Stow						52203,2
	Broadway Beacon from Epwell						80611,4

No. of triangles.	Names of stations.	Observed angles.	Diff.	Spherical excess.	Error.	Angles corrected for calculation.	Distances.
		° ′ ″	″	″	″	° ′ ″	Feet.
XXXVII.	Broadway Beacon	56 32 45	—0,34			56 32 44,75	
	Epwell -	95 34 25,25	—1,62			95 34 24,75	
	Corley - -	27 52 49,75	—0,61			27 52 50,5	
		180 0 0		1,58	—1,58		
	Corley from Broadway Beacon - -						171568
XXXVIII.	Brill - -	34 23 58,5	—0,65			34 23 57,5	
	Epwell -	85 0 18,5	—1,10			85 0 17,5	
	Arbury Hill -	60 35 45,5	—0,70			60 35 57,5	
		180 0 2,5		2,46	—0,04		
	Arbury Hill from Epwell -						83098,4
	Arbury Hill from Brill - -						146530
XXXIX.	Arbury Hill -	89 57 4,5	—1,14			89 57 5,5	
	Epwell -	54 45 18,75	—0,57			54 45 18,25	
	Corley -	35 17 36,75	—0,57			35 17 36,25	
		180 0 0		2,29	—2,29		
	Corley from Arbury Hill -						117463
	Corley from Epwell - -						143827,8

By the triangle Broadway Beacon, Epwell, Corley, (see the above) the distance from Corley to Broadway Beacon is the only distance computed; and this has been obtained through the means of two observed angles only. When the observations were made at Broadway Beacon, it was not imagined Corley could be seen; and the contrary was not known till the party arrived at the latter place. In so large a triangle, it would certainly be right to observe all the angles: but I have given the angles as they now stand, because the distance from Epwell to Corley comes out 143831 feet, which determination differs only three feet from the same distance found by the last triangle.

XL.	Bow Brickhill -	68 22 56,75	—1,21			68 22 59	
	Arbury Hill -	43 16 55,5	—0,99			43 16 54,5	
	Brill - -	68 20 7,75	—1,22			68 20 6,5	
		180 0 0		3,43	—3,43		
	Bow Brickhill from Arbury Hill - -						146481
	Bow Brickhill from Brill - -						108058,9

It will now be expedient to compute the distance from Bow Brickhill to Brill, by means of another set of triangles. And it was for the express purpose of verifying this distance found by the last triangle, that Scutchamfly Barrow, in Berkshire, and the station above Wendover, were chosen. The base on which these triangles are to rest, is the distance between Nuffield and White Horse Hill, *viz.* 120557,7 feet.

No. of triangles	Names of stations.	Observed angles.	Diff.	Spherical excess.	Error.	Angles corrected for calculation.	Distances.
		° ′ ″	″	″	″	° ′ ″	Feet.
XLI.	Nuffield -	62 32 5,25	−0,53			62 32 6	
	White Horse Hill	35 34 23,25	−0,47			35 34 24	
	Shotover Hill -	81 53 29,75	−0,74			81 53 30	
		179 59 58,25		1,75	−3,5		
	Shotover Hill from { White Horse Hill -						108050,2
	Shotover Hill from { Nuffield - -						70842,1
XLII.	Shotover Hill -	26 8 8	−0,12			26 8 8	
	White Horse Hill	42 4 2	−0,04			42 4 2	
	Scutchamfly Barrow	111 47 50	−0,70			111 47 50	
		180 0 0		0,86	−0,86		
	Scutchamfly Barrow from { White Horse Hill -						51261,9
	Scutchamfly Barrow from { Shotover Hill - -						77968,3
XLIII.	Shotover Hill -	117 30 56	−1,41			117 30 55,25	
	Scutchamfly Barrow	34 26 52	−0,01			34 26 52	
	Wendover -	28 2 12,75	−0,09			28 2 12,75	
		180 0 0,75		1,52	−0,77		
	Wendover from { Scutchamfly Barrow -						147113,3
	Wendover from { Shotover - -						93828,6

No. of triangles	Names of Stations.	Observed angles.	Diff.	Spherical excess.	Error.	Angles corrected for calculation.	Distances.
		° ′ ″	″	″	″	° ′ ″	Feet.
XLIV.	Wendover -	23 23 57,5	0,11			23 23 57,25	
	Shotover Hill -	48 30 39,75	0,04			48 30 40,5	
	Brill - -	. . .				108 5 22,25	
				1,21			
	Brill from Wendover - - -						73940,3
	Brill from Shotover Hill -						39200,2
XLV.	Wendover -	80 11 9,25	—0,67			80 11 8,5	
	Brill - -	57 25 1,5	—0,47			57 25 0,75	
	Bow Brickhill -	42 23 50,75	—0,44			42 23 50,75	
		180 0 1,51		1,58	—0,07		
	Bow Brickhill from Wendover - -						92400,7
	Bow Brickhill from Brill - - -						108055

According to the first determination, the distance from Bow Brickhill to Brill is 108058,9 feet, and by the last, 108855 feet. There is, therefore, a difference of 4 feet nearly; a quantity which must be deemed inconsiderable; hence, 108056,9 feet may be taken for the true distance.

XLVI.	Kinsworth -	62 55 38,75				62 55 38,5	
	Bow Brickhill -	88 42 0				88 41 59,25	
	Brill - -	. . .				28 22 22,25	
	Kinsworth from Brill - -						121322,5
	Kinsworth from Bow Brickhill - -						57668
XLVII	Wendover -	33 26 48				33 26 49	
	Quainton - -	94 58 37				94 58 38	
	Brill - -	51 34 33				51 34 33	
		179 59 58		0,55	—2,55		
	Quainton from Brill - -						40908
	Quainton from Wendover - -						58146,4

No. of triangles	Names of Stations.	Angles observed.	Diff.	Spherical excess.	Error.	Angles corrected for calculation.	Distances.
		° ′ ″	″	″	″	° ′ ″	Feet.
XLVIII	Bow Brickhill -	38 51 40,75				38 51 40,75	
	Wendover - -	46 44 29,5				46 44 29,25	
	Quainton -	94 23 50,25				94 23 50	
		180 0 1,25		0,83	+0,42		
		Quainton from { Wendover - -					58146,9
		Quainton from { Bow Brickhill -					67491,3

In the above triangle, I have computed the distances of Wendover and Bow Brickhill from Quainton with 92400,7 feet, the side Wendover and Bow Brickhill, as determined in a former triangle.

XLIX.	Bow Brickhill -	85 9 52,75				85 9 52	
	Kinsworth -	52 17 56,75				52 17 56	
	Quainton - -	. . .				42 32 12	
		Quainton from { Kinsworth - -					84997
		Quainton from { Bow Brickhill -					67490,3

Therefore, 67490 may be considered as nearly the true distance, in feet, between Quainton and Bow Brickhill.

L.	Bow Brickhill -	42 10 36,75				42 10 36,5	
	Kinsworth -	82 50 30,5				82 50 30	
	Lillyhoe - -	54 38 53				54 38 53,5	
		180 0 0,25		1,26	—1,50		
		Lillyhoe from { Kinsworth -					47278,7
		Lillyhoe from { Bow Brickhill -					69867

As the stations Lidlington, Trusler Hill, together with Crouch Hill, Cumner Hill, and Whiteham Hill, have been used for purposes of greater importance than secondary ones have been generally applied to, I shall insert the triangles formed by their intersections in this article.

No. of triangles	Names of stations.	Observed angles.	Diff.	Spherical excess.	Error.	Angles corrected for calculation.	Distances.
		° ′ ″	″	″	″	° ′ ″	Feet.
LI.	Kinsworth -	31 4 5				31 4 4	
	Bow Brickhill -	80 39 37,25				80 39 34,75	
	Lidlington -	68 16 22,25				68 16 21,25	
		180 0 4,5		0,42	+4,92		
	Lidlington from Bow Brickhill -						32035,6
	Lidlington from Kinsworth -						61255,3
LII.	Lillyhoe - -	78 58 26				78 58 26	
	Kinsworth -	51 46 22				51 46 22	
	Lidlington -	. . .				49 15 12	
	Lillyhoe from Kinsworth - -						47280
	Lillyhoe from Lidlington -						49025

The distance from Lillyhoe to Kinsworth, as found in a former triangle, is 47278,1 feet, and by the last 47280 feet; therefore, 47279,3 may be taken for the true distance in feet.

LIII.	Bow Brickhill -	38 28 56				38 28 56	
	Lillyhoe - -	23 59 31				23 59 31	
	Lidlington -	. . .				117 31 33	
	Lillyhoe from Lidlington - -						49027,3
	Lillyhoe from Bow Brickhill -						69869

And this triangle, with that preceding it, gives the mean distance between Lillyhoe and Lidlington = 49026,1 feet; and, with the triangle Lillyhoe, Kinsworth, and Bow Brickhill, it assigns 69868 feet for the mean distance between Lillyhoe and Bow Brickhill.

LIV.	Lillyhoe - -	5 52 11,5				5 52 11,5	
	Bow Brickhill -	14 54 42,75				14 54 42,75	
	Trusler Hill -	. . .				159 13 5,75	
	Trusler Hill from Bow Brickhill -						20138,7
	Trusler Hill from Lillyhoe - -						50673,6

No. of triangles	Names of stations.	Observed angles.	Diff.	Spheri-cal excess.	Error.	Angles corrected for calculation.	Distances.
		° ′ ″	″	″	″	° ′ ″	Feet.
LIV.	Crouch Hill -	145 23 26,25				145 23 26	
	Epwell - -	27 3 10				27 3 10	
	Brill - - -	. . .				7 33 24	
	Crouch Hill from { Brill - -						102608
	Epwell - -						29668,8

Distance from White Horse Hill to Shotover Hill 108050,2 feet.

No. of triangles	Names of stations.	Observed angles.	Diff.	Spheri-cal excess.	Error.	Angles corrected for calculation.	Distances.
LV.	Shotover Hill -	48 5 32,75				48 5 32,25	
	White Horse -	16 59 53,75				16 59 53,25	
	Whiteham Hill -	114 54 34,75				114 54 34,5	
		180 0 1,25					
	Whiteham Hill from { White Horse Hill -						88662,2
	Shotover Hill -						34827,4
LVI.	Whiteham Hill -	55 52 35				55 52 36	
	Shotover Hill -	24 37 36				24 37 37	
	Cumner Hill -	99 29 48,5				99 29 47	
		179 59 59,5					
	Cumner Hill from { Shotover Hill - -						29231,5
	Whiteham Hill -						14714,3

And, because the Observatory of his Grace the Duke of MARLBOROUGH, at Blenheim, together with that at Oxford, have been observed with the same care and attention as the principal stations, and also because precise determinations of the situations are of great importance, I shall here insert the triangles formed by their intersections.

No. of triangles	Names of stations.	Observed angles.	Diff	Spherical excess.	Error.	Angles corrected for calculation.	Distances.
		° ' "	"	"	"	° ' "	Feet.
LVII.	Shotover Hill - -	23 11 5				23 11 5	
	Cumner Hill - -	29 23 33				29 23 33	
	The Atlas on the top of the Observatory at Oxford	. . .				127 25 22	
	Oxford Observatory from Cumner Hill - -						14492
	Oxford Observatory from Shotover Hill - -						18065,1
LVIII.	Whiteham Hill -	131 25 36,5				131 25 35,5	
	White Horse Hill -	10 30 43,5				10 30 43,75	
	Blenheim Observatory	. . .				38 3 40,75	
	Blenheim Observatory from White Horse Hill -						107831,9
	Blenheim Observatory from Whiteham Hill - -						26237,6

ART. XIV. *Triangles for connecting the Series carried on from Scutchamfly Barrow and White Horse Hill, in Berkshire, into Buckinghamshire and Bedfordshire, with the Series carried on for the Survey of Essex.*

The angle at St. Ann's Hill, between the station on Hanger Hill Tower and Hampton Poor House, inferred from General ROY's Account, is 25° 33' 58",5. In 1793, the angle between the staff on Pen Church Tower and Hampton Poor House was taken, and found = 95° 57' 34",5; therefore, the angle between Pen Tower and Hanger Hill is 70° 23' 36".

The distance from St. Ann's Hill to Pen is determined by the following triangle; in which the distance between St. Ann's Hill and Bagshot Heath, *viz.* 46955,3 feet, (see Phil. Trans. for 1795, p. 496,) is used for the base.

No. of triangles	Names of stations.	Observed angles.	Diff.	Spherical excess.	Error.	Angles corrected for calculation.	Distances.
		° ′ ″	″	″	″	° ′ ″	Feet.
LIX.	St. Ann's Hill	80 43 48				80 43 48	
	Bagshot - -	70 30 37				70 30 37	
	Pen Tower -	. . .				28 45 35	
						Pen Tower from St. Ann's Hill - -	92000,5
						Pen Tower from Bagshot Heath - -	96318

The distance from St. Ann's Hill to Hanger Hill Tower is 68895,8 feet: this is derived from the *mean* length of the base on Hounslow Heath. This side, together with St. Ann's Hill and Pen, using the included angle at St. Ann's Hill, as found above, give 94640,5 feet, for the distance between Pen and Hanger Hill Towers.

The angle at St. Ann's Hill, between Bagshot Heath and Hanger Hill Tower, is 151° 7′ 24″,25: this, with the sides Bagshot Heath and St. Ann's, St. Ann's and Hanger Hill, give 17° 13′ 48″, for the angle at Bagshot Heath, between Hanger Hill Tower and St. Ann's Hill: hence we have the following triangle.

Bagshot Heath - -	16° 45′ 43″
Hanger Hill - -	103 18 23
Stanmore - - -	59 55 54

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Which triangle gives 37431 feet, for the distance between Stanmore and Hanger Hill Tower.

The angle at the station on Bow Brickhill, (see the preceding article,) between Wendover and Kinsworth, is 46° 18′ 8″,5; and the distances from it to these stations are 92402,2 feet, and 57668 feet respectively: these give the following triangle.

Bow Brickhill	-	46°	18′.	8″,5
Wendover -	-	38	25	21,25
Kinsworth	- -	95	16	30,25

From which the distance between Wendover and Kinsworth is found = 67090,7 feet. The observed angle at Wendover, between Bow Brickhill and Stanmore, is 102° 22′ 29″; from which, subtracting 38° 25′ 21″,25, the angle between Bow Brickhill and Kinsworth, we get 63° 57′ 7″,75, for the angle between Kinsworth and Stanmore. Again, the observed angle at Kinsworth, between Bow Brickhill and Stanmore, is 173° 37′ 44″; from which, subtracting the angle between Bow Brickhill and Wendover, we get 78° 21′ 13″,75, for the angle between Stanmore and Wendover. If these *computed* angles are actually such as might be observed, were Kinsworth and Wendover visible from each other, the angle at Stanmore between those stations ought to be 37° 41′ 39″, nearly: but the observed angle was 37° 41′ 41″,75; which is so nearly the computed one, as to leave little doubt of the accuracy of those *data* from which the angles are derived. The distance from Wendover to Kinsworth is 67090,7 feet.

	°	′	″	
Wendover -	63	57	7,75	which, corrected for calculation, becomes,
Kinsworth -	78	21	13,75	
Stanmore - -	37	41	41,75	
	180	0	3,25	

Wendover - 63 57 7
Kinsworth - 78 21 12
Stanmore - 37 41 41 which triangle gives

the distance of Stanmore from $\left\{\begin{array}{l}\text{Wendover} = 107464{,}1\\ \text{Kinsworth} = 98577{,}5\end{array}\right\}$ feet.

In consequence of Bushy Heath intercepting the view towards the east from Stanmore, it became necessary to choose a station on the former. To determine the distance, the angles at the two stations were taken very accurately; they were as follows,

Stanmore - 42 11 21,5
Bushy Heath 135 35 40,5
Kinsworth, . . . which gives 5483,3 feet for the required distance.

To determine the distance of the station on Pen Church Tower, we have two angles in the following triangle, *viz.*

Wendover - 38 13 18
Stanmore - 23 44 48
Pen Tower - 118 1 54 } which, corrected for calculation, becomes,

Wendover - 38 13 18,25
Stanmore - 23 44 48,25
Pen Tower - 118 1 54,5 which triangle gives

the distance of Pen from $\left\{\begin{array}{l}\text{Wendover} = 49027\\ \text{Stanmore} = 75325{,}4\end{array}\right\}$ feet.

With this distance of Stanmore from Pen, found from the last triangle, and also that between Stanmore and Hanger Hill, derived from the triangle, Bagshot Heath, Hanger Hill, and Stanmore, together with the included angle at Stanmore, *viz.* 109′ 28′ 22″,5, we get the distance of Pen to Hanger Hill Tower = 94631,8 feet. The same distance has been found before, in a shorter and more direct way, being 94640,5 feet:—the difference is only 8,7 feet; a sufficient proof that the distances given for the survey of this intricate and woody country, are sufficiently correct. It will be more convenient to show how these triangles are connected with those to the eastward, when I arrive at that part of the work which treats of the survey of Essex, than at present. I shall, therefore, proceed to the following article, after observing, that by the help of Harrow Spire, (the situation of which has been determined by General Roy,) and by observations hereafter to be made with the small instrument on Pen Tower, less difficulty will occur in the interior survey than was at first expected.

ART. XV. *Triangles formed by the intersections of Churches, Windmills, and other Objects.*

Triangles.	Angles observed.	Distances of the Stations from the intersected Objects.	
	° ′ ″		Feet.
Little Haldon	23 54 50	Great Haldon	18974
Ball's Obelisk	132 41 8		19366
Great Haldon, secondary station			

Great Haldon from Ball's Obelisk 19366 feet.

Triangles.	Angles observed.	Distances of the Stations from the intersected Objects.	Feet.
Great Haldon	68 0 35	Topsham Steeple	28316
Ball's Obelisk	71 32 30		27679
Topsham Steeple			

Little Haldon from Furland 72776 feet.

Triangles.	Angles observed.	Distances of the Stations from the intersected Objects.	Feet.
Little Haldon	18 2 2	Hope's Nose	37656
Furland	18 42 53		39028
Hope's Nose, secondary station			

Bodmin from Trevose 81967,6 feet.

Triangles.	Angles observed.	Distances of the Stations from the intersected Objects.	Feet.
Bodmin	15 48 43	St. Minvern Steeple	45936
Trevose	21 28 36		36866
St. Minvern Steeple			
Bodmin	12 5 33	St. Minvern Windmill	34852
Trevose	8 46 51		48478
St. Minvern Windmill			

Trevose from Cadon Barrow 85624,8 feet.

Triangles.	Angles observed.			Distances of the stations from the intersected objects.	
	°	′	″		
Trevose	55	38	59	St. Isey Steeple	29256
Cadon Barrow	19	15	48		73216
St. Isey Steeple					
Trevose	58	41	39	St. Merian Steeple	10894
Cadon Barrow	6	38	22		80504
St. Merian Steeple					

Black Down from St. Stephen's 62506,7 feet.

Black Down	4	46	37	Werrington Steeple	61289
St. Stephen's Down	74	20	14		5301
Werrington Steeple					
Black Down	15	18	49	Boyton Steeple	69897
St. Stephen's	104	53	9		19101
Boyton Steeple					
Black Down	1	8	22	St. Stephen's Steeple	60448
St. Stephen's	30	7	22		2395
St. Stephen's Steeple					
Black Down	5	31	36	North Petherwin Steeple	77698
St. Stephen's	153	13	23		16610
North Petherwin Steeple					

Carraton from St. Stephen's 52994 feet.

Carraton	50	40	15	Stokeclimsland Steeple	32886
St. Stephen's	38	21	4		40997
Stokeclimsland Steeple					
Carraton	6	11	7	Launceston Steeple	49613
St. Stephen's	55	32	16		6483
Launceston Steeple					
Carraton	5	58	26	Launceston Chapel	49404
St. Stephen's	53	7	35		6427
Launceston Chapel					

Long Knoll from Westbury 58118,2 feet.

Long Knoll	45	5	0	Frome Steeple	33765
Westbury	34	53	50		41793
Frome Steeple					

Lansdown from Farley Down 28730,4 feet.

Triangles.	Angles observed.	Distances of the stations from the intersected objects.	
	° ' "		Feet.
Lansdown	56 43 16	Cold Aston	13563
Farley Down	28 2 35		24120
Cold Aston			

Moor Lynch from Dundon 32688,8 feet.

Triangles.	Angles observed.	Distances of the stations from the intersected objects.	Feet.
Moor Lynch	15 54 56	Walton Windmill	20406
Dundon	23 11 6		14213
Walton Windmill			
Moor Lynch	123 0 11	Westonzoyland Steeple	17688
Dundon	19 18 55		44848
Westonzoyland Steeple			
Moor Lynch	91 5 56	Middlezoy Steeple	15691
Dundon	25 26 0		36530
Middlezoy Steeple			
Moor Lynch	153 58 50	Chedzoy Steeple	19454
Dundon	9 39 13		29556
Chedzoy Steeple			
Moor Lynch	29 20 18	Highham Windmill	24457
Dundon	46 30 22		16518
Highham Windmill			
Moor Lynch	36 25 56	Highham Steeple	21567
Dundon	39 51 57		19982
Highham Steeple			
Moor Lynch	147 57 0	Bridgewater Spire	33656
Dundon	16 15 14		63768
Bridgewater Spire			
Moor Lynch	69 52 39	Burton Pynsent Obelisk	40063
Dundon	63 18 59		42101
Burton Pynsent Obelisk			
Moor Lynch	12 12 41	Somerton Steeple	40792
Dundon	129 45 57		11221
Somerton Steeple			

Dundry from Lansdown 55248,9 feet.

Triangles.	Angles observed.			Distances of the stations from the intersected objects.	
	°	′	″		Feet.
Dundry - - -	22	7	16	Puckle Church Steeple	57757
Lansdown - -	85	25	0		21819
Puckle Church Steeple					
Dundry - - -	30	37	18	Westleigh Steeple -	61842
Lansdown - - -	86	18	39		31566
Westleigh Steeple					
Dundry - - -	51	19	11	Bristol Cathedral -	21920
Lansdown - -	22	23	3		44935
Bristol Cathedral					
Dundry - - -	44	18	9	Redcliff Steeple -	22096
Lansdown - - -	21	22	24		42346
Redcliff Steeple					
Dundry - - -	78	18	19	Long Aston Steeple -	13883
Lansdown - - -	14	32	8		54168
Long Aston Steeple					
Dundry - - -	67	33	51	Clifden Windmill -	12860
Lansdown - -	13	17	8		51725
Clifden Windmill					
Dundry - - -	75	37	25	Blaze Castle -	38391
Lansdown - -	39	7	35		58932
Blaze Castle					
Dundry - - -	89	10	18	Penpole Park Gazebo	35391
Lansdown - - -	32	52	56		65180
Penpole Park Gazebo					
Dundry - - -	32	16	31	St. George's Steeple -	32391
Lansdown - - -	31	49	52		32795
St. George's Steeple					
Dundry - - -	44	54	50	Duke of Beaufort's House	41168
Lansdown - - -	48	5	1		39064
Duke of Beaufort's House, Stoke					
Dundry - - -	57	15	32	Harfield Steeple - -	35182
Lansdown - - -	39	14	57		46773
Harfield Steeple					

Triangles.	Angles observed.	Distances of the Stations from the intersected Objects	
	° ′ ″		Feet.
Dundry - - -	13 58 8	Durham Steeple -	66541
Lansdown - - -	120 8 3		18573
Durham Steeple			
Dundry - - -	63 45 11	Knowle Steeple -	56512
Lansdown - - -	59 9 55		59030
Knowle Steeple			
Dundry - - -	29 42 10	Mangotsfield Steeple -	47845
Lansdown - - -	59 59 41		27376
Mangotsfield Steeple			
Dundry - - -	46 12 31	Winterbourn Steeple -	55045
Lansdown - -	66 38 49		43280
Winterbourn Steeple			

Mendip from Dundry 69196 feet.

Dundry - - -	15 0 54	Leigh Steeple on Mendip	76847
Mendip - - -	104 10 15		20533
Leigh Steeple on Mendip			
Dundry - - -	90 22 22	Dundry Steeple -	1417
Mendip - - -	1 10 22		69221
Dundry Steeple			

Mendip from Long Knoll 61962,5 feet,

Long Knoll - - -	7 20 24	Doulting Spire -	49286
Mendip - - -	25 42 22		14517
Doulting Spire			

Farley Down from Westbury 59849,5 feet,

Westbury - - -	81 25 20	Devizes Steeple -	51197
Farley Down - - -	44 6 53		72726
Devizes Steeple			

Whitehorse from Scutchamfly 51261,9 feet.

Whitehorse - - -	32 55 51	Abingdon Spire -	72898
Scutchamfly - - -	104 3 27		40852
Abingdon Spire			

Triangles.	Angles observed.			Distances of the Stations from the intersected Objects.	
	°	′	″		Feet.
Whitehorse - - -	10	39	30	Wallingford Steeple -	101693
Scutchamfly - - -	158	52	26		52185
Wallingford Steeple					
Whitehorse - - -	121	19	20	Great Coxwell Windmill	30295
Scutchamfly - -	21	7	0		71834
Great Coxwell Windmill					
Whitehorse - - -	153	24	7	Highworth Steeple -	38449
Scutchamfly - -	11	21	56		87355
Highworth Steeple					
Whitehorse - - -	28	6	9	Drayton Steeple -	63991
Scutchamfly - - -	99	45	35		30586
Drayton Steeple					
Whitehorse - - -	34	8	57	Radley Steeple -	81618
Scutchamfly - - -	109	33	56		48624
Radley Steeple					
Whitehorse - - -	75	25	57	Buckland Steeple -	41189
Scutchamfly - - -	44	15	50		57115
Buckland Steeple					
Whitehorse - - -	81	19	12	Witney Steeple -	57229
Scutchamfly - - - -	62	34	49		86007
Witney Steeple					
Whitehorse - - -	90	57	40	Bampton Steeple -	58992
Scutchamfly - - -	48	27	50		78799
Bampton Steeple					

Whiteham from Brill 62066,1 feet.

Triangles.	Angles observed.			Distances of the Stations from the intersected Objects.	
Whiteham - - -	19	47	5	Islip Steeple - -	28983
Brill - - - -	14	55	46		38073
Islip Steeple					
Whiteham - - -	78	47	7	Woodstock Steeple -	37956
Brill - - - -	25	3	58		64725
Woodstock Steeple					
Whiteham - - -	38	39	25	Kidlington Spire -	24677
Brill - - - -	18	59	22		47373
Kidlington Spire					

Whitehorse from Brill 146603,2 feet,

Triangles.	Angles observed.			Distances of the Stations from the intersected Objects.	
	°	′	″		Feet.
Whitehorse - - - -	46	10	15	Witchwood Forest Beacon	95439
Brill - - - - -	40	32	9		105936
Witchwood Forest Beacon					

Broadway from Epwell 80611,4 feet.

Broadway - - - -	46	51	21	Warwick Steeple -	109337
Epwell - - - - -	85	48	34		79992
Warwick Steeple					
Broadway - - - -	49	43	19	St. Martin's, Coventry -	158205
Epwell - - - - -	100	10	39		122627
St. Martin's Spire, Coventry					
Broadway - - - -	71	52	32	Soleyhull Spire -	142027
Epwell - - - - -	74	53	55		139806
Soleyhull Spire					

Corley from Arbury Hill 117463 feet.

Corley - - - - -	10	17	47	Dun Church Windmill	70621
Arbury - - - - -	18	1	45		44249
Dun Church Windmill					
Corley - - - - -	107	11	9	Gazebo on Bardon Hill	106471
Arbury - - - - -	34	20	2		180344
Gazebo on Bardon Hill, Leicestershire					
Corley - - - - -	100	41	54	Markfield Windmill -	103373
Arbury - - - - -	36	37	26		170270
Markfield Windmill					
Corley - - - - -	2	45	41	Newnham Windmill -	118771
Arbury - - - -	101	33	35		5845
Newnham Windmill					

Corley from Broadway 171570 feet.

Broadway - - - -	96	31	27	Building on Breadon Hill	46201
Corley - - - - -	14	33	9		182682
Building on Breadon Hill					

Epwell from Crouch Hill 29668,8 feet,

Triangles.	Angles observed.			Distances of the Stations from the intersected Objects.	
	°	′	″		Feet.
Epwell	24	43	28	Deddington Steeple	47493
Crouch Hill	124	8	31		24000
Deddington Steeple					
Epwell	22	2	57	Bloxham Spire	31887
Crouch Hill	89	27	20		11971
Bloxham Spire					
Epwell	12	41	39	Aynoe Steeple	60070
Crouch Hill	155	28	33		31802
Aynoe Steeple					
Epwell	12	45	23	Adderbury Spire	43823
Crouch Hill	143	29	30		16265
Adderbury Spire					
Epwell	9	33	29	Farthingo Steeple	64520
Crouch Hill	162	29	20		35605
Farthingo Steeple					

Epwell from Arbury Hill 83098,4 feet.

Triangles.	°	′	″	Distances of the Stations from the intersected Objects.	Feet.
Epwell	27	30	1	Round House, Edge Hills	20235
Arbury Hill	8	9	42		65816
Round House, Edge Hills					
Epwell	50	9	8	St. Martin's, Coventry	122636
Arbury Hill	87	15	6		94262
St. Martin's, Coventry					
Epwell	28	31	46	Round House Windmill	18576
Arbury Hill	7	34	6		67364
Round House Windmill, Edge Hills					

Brill from Quainton 40908,6 feet.

Triangles.	°	′	″	Distances of the Stations from the intersected Objects.	Feet.
Brill	19	36	52	Wingrove Steeple	75747
Quainton	140	7	47		39665
Wingrove Steeple					
Brill	16	25	48	Hardwick Steeple	55539
Quainton	128	12	5		19989
Hardwick Steeple					

Triangles.	Angles observed.	Distances of the Stations from the intersected Objects.	
	° ′ ″		Feet.
Brill - - - - Quainton - - - - *Luggersal Steeple*	16 42 12 4 24 16	Luggersal Steeple -	8710 32664
Brill - - - - Quainton - - - *Granborough Steeple*	8 30 43 144 20 22	Granborough Steeple -	52266 13270
Brill - - - - Quainton - - - - *Bicester Steeple*	105 7 30 32 10 53	Bicester Steeple -	32132 58210
Brill - - - - Quainton - - - *Centre of the Great House at Wooton*	17 37 12 9 28 57	House at Wooton -	14793 27181

Stow from Broadway 52203,2 feet.

Stow - - - - Broadway - - - *Sarsden Chapel*	123 23 50 19 25 13	Sarsden Chapel -	28720 72115
Stow - - - Broadway - - - *Walford Spire*	56 10 42 49 34 47	Walford Spire -	41295 45063
Stow - - - Broadway - - - *Bourton Chapel*	14 3 44 21 32 40	Bourton Chapel -	32926 21786

Stow from Epwell 78938,2 feet.

Stow - - - - - Epwell - - - - - *Stow on the Wold Steeple*	60 30 20 6 37 9	Stow on the Wold -	9876 74573

Wendover from Brill 92409,7 feet.

Brill - - - Wendover - - - *Pitchcot Windmill*	43 30 12 46 37 4	Pitchcot Windmill -	53739 50901

Triangles.	Angles observed.	Distances of the Stations from the intersected Objects.	
	° ′ ″		Feet.
Brill Wendover *Ivinghoe Spire*	24 15 12 111 33 40	Ivinghoe Spire	98663 43577
Brill Wendover *Padbury Steeple* (doubtful)	66 36 4 46 32 33	Padbury Steeple	72943 92401
Brill Wendover *Quainton Steeple*	46 40 52 31 1 48	Quainton Steeple	39009 55056

Wendover from Quainton 72889,4 feet.

Wendover Quainton *Wing Steeple*	34 46 37 45 9 20	Wing Steeple	52487 42230
Wendover Quainton *Crindon Windmill*	44 58 11 61 9 59	Crindon Windmill	66472 53626

Quainton from Bow Brickhill 67490,6 feet.

Quainton Bow Brickhill *Southern Obelisk, Stow Park, Bucks*	75 15 34 47 19 1	Southern Obelisk	58876 77449
Quainton Bow Brickhill *Northern Obelisk, Stow Park*	75 4 46 49 13 49	Northern Obelisk	61881 78942

Wendover from Kinsworth 84462 feet.

Kinsworth Wendover *Leighton Buzzard Spire*	69 56 52 31 6 26	Leighton Buzzard	35317 64215

Kinsworth from Quainton 84996,3 feet.

Kinsworth Quainton *Aylesbury Steeple*	17 49 12 51 5 23	Aylesbury Steeple	70886 27879

Bow Brickhill from Lidlington 32035,6 feet.

Triangles.	Angles observed.			Distances of the Stations from the intersected Objects.	
	°	′	″		Feet.
Bow Brickhill - - -	57	43	21	North Crawley Spire -	34968
Lidlington - - -	65	40	39		32444
North Crawley Spire					
Bow Brickhill - - -	45	8	47	Pavenham Spire -	77064
Lidlington - - - -	112	13	11		59014
Pavenham Spire					
Bow Brickhill - - -	24	15	25	St. Paul's, Bedford -	68727
Lidlington - - -	137	19	21		41652
St. Paul's Spire, Bedford					
Bow Brickhill - -	48	2	42	Sharnbrook Spire -	84080
Lidlington - - -	111	8	15		67038
Sharnbrook Spire					
Bow Brickhill - - -	38	42	47	Woburn Market House	12656
Lidlington - - -	19	39	20		23533
Woburn Market House					
Bow Brickhill - - -	5	3	35	Ridgemont Station -	21484
Lidlington - - -	10	6	1		10804
Ridgemont Station					
Bow Brickhill - - -	25	51	29	Wootton Spire -	46959
Lidlington - - -	116	31	15		22889
Wootton Spire					
Bow Brickhill - - -	36	40	14	Cranfield Spire -	29599
Lidlington - - -	64	51	26		19526
Cranfield Spire					

Lillyhoe from Lidlington 49026,1 feet.

Triangles.	Angles observed.			Distances of the Stations from the intersected Objects.	
	°	′	″		Feet.
Lillyhoe - - - - -	3	1	25	Pollux Hill Spire -	24604
Lidlington - - - - -	3	2	16		24489
Pollux Hill Spire					
Lillyhoe - - -	23	13	23	Bow Brickhill Steeple	70224
Lidlington - - -	119	15	11		31738
Bow Brickhill Steeple					
Lillyhoe - - -	49	54	3	Colmworth Spire -	97617
Lidlington - - -	100	30	33		75944
Colmworth Spire					

Triangles.	Angles observed.	Distances of the stations from the intersected objects.	
	° ′ ″		Feet.
Lillyhoe - - - Lidlington - - - *Silsoe Spire*	23 57 30 22 4 36	Silsoe Spire -	25599 27658
Lillyhoe - - - Lidlington - - - *Flitton Steeple*	11 46 23 17 18 29	Flitton Steeple -	30008 20580
Lillyhoe - - - Lidlington - - - *Shillington Steeple*	57 56 38 19 37 7	Shillington Steeple	16857 42549
Lillyhoe - - - Lidlington - - - *Westoning Steeple*	14 35 24 24 29 56	Westoning Steeple -	32242 19586
Lillyhoe - - - Lidlington - - - *Wrest Garden Obelisk*	23 40 47 19 18 12	Wrest Garden Obelisk	23770 28880
Lillyhoe - - - Lidlington - - - *St. Neot's Steeple*	63 39 11 88 31 51	St. Neot's Steeple -	105026 94147

Kinsworth from Lidlington 61255,3 feet.

Kinsworth - - - Lidlington - - *Harlington Steeple*	17 4 20 23 39 1	Harlington Steeple -	37666 27565
Kinsworth - - - Lidlington - - *Maulden Steeple*	17 22 11 87 3 13	Maulden Steeple -	63165 18882
Kinsworth - - - Lidlington - - *Millbrook Steeple*	3 53 24 73 16 9	Millbrook Steeple -	60167 42622
Kinsworth - - - Lidlington - - - - *Streatly Steeple*	36 15 30 33 41 7	Streatly Steeple -	36167 38567
Kinsworth - - - Lidlington - - - *Hanslop Spire*	34 29 11 166 4 4	Hanslop Spire -	111928 70552

Kinsworth from Bow Brickhill 57668 feet.

Triangles.	Angles observed.	Distances of the Stations from the intersected Objects.	
	° ′ ″		Feet.
Bow Brickhill - - Kinsworth - - - *Souldrope Spire*	131 31 20 30 17 44	Souldrope Spire -	93229 138367
Bow Brickhill - - Kinsworth - - - *Sauldon Windmill*	91 22 55 28 24 55	Sauldon Windmill -	31623 66434
Bow Brickhill - - Kinsworth - - - *Stewkley Windmill*	70 9 33 33 27 4	Stewkley Windmill -	32706 55812
Bow Brickhill - - Kinsworth - - - *Tharfield Windmill*	61 57 57 93 36 13	Tharfield Windmill -	139157 123073
Bow Brickhill - - Kinsworth - - - *Tottenhoe Station*	4 13 44 14 47 27	Tottenhoe Station -	43177 13049
Bow Brickhill - - Kinsworth - - - *Chalgrave Steeple*	21 55 14 43 21 54	Chalgrave Steeple -	43590 23699
Bow Brickhill - - Kinsworth - - - *Lidlington Windmill* -	85 34 3 27 23 29	Lidlington Windmill -	28814 62442
Bow Brickhill - - Kinsworth - - - *Keysoe Spire*	116 46 10 42 6 4	Keysoe Spire -	107275 142850

Lillyhoe from Trusler Hill 50673,6 feet.

Lillyhoe - - - Trusler Hill - - *Knotting Green Elm Tree*	51 56 21 103 29 55	Knotting Green Elm Tree	118536 95981
Lillyhoe - - - Trusler Hill - - *Sundon Windmill*	36 45 37 27 4 1	Sundon Windmill -	25692 33790

Bow Brickhill from Truſler Hill 20138,7 feet.

Triangles.	Angles obſerved.	Diſtances of the ſtations from the interſected objects.	
	° ′ ″		
Bow Brickhill - -	25 13 54	Crawley Steeple -	15998
Truſler Hill - - -	50 16 22		8867
Crawley Steeple			
Bow Brickhill - -	93 18 15	Moulshoe Steeple -	25136
Truſler Hill - - -	49 17 46		33[illegible]
Moulsboe Steeple			
Bow Brickhill - -	13 27 1,7	Woburn Steeple -	12432
Truſler Hill - - -	19 46 14		8552
Woburn Steeple			

Bow Brickhill from Lillyhoe 69867 feet.

Bow Brickhill - -	60 57 17	Renhold Steeple -	84608
Lillyhoe - - -	68 43 59		79373
Renbold Steeple			
Bow Brickhill - -	64 55 32	Ravensden Steeple -	85825
Lillyhoe - - -	66 41 24		84646
Ravensden Steeple			

Kinsworth from Lillyhoe 47278,7 feet.

Kinsworth - - -	43 44 48	Flitwick Steeple -	49849
Lillyhoe - - -	71 53 53		36264
Flitwick Steeple			

SECTION SECOND.

Determination of the Latitudes and Longitudes of the Stations on Black Down, in Dorsetshire, Butterton, in Devonshire, and St. Agnes Beacon, in Cornwall.

ART. XVI.—*Calculation of the Distance between Black Down and Dunnose in the Isle of Wight.*

To complete this distance, I shall have recourse to the XXVIth and XXVIIth triangles, published in the Philosophical Transactions of 1795, and LIIId and LIVth of the Trans. for 1797, together with the observations made at Black Down, in the latter year. (See also Pl. XXX. Fig. 1.).

The most eligible method of calculating with these *data*, seems to be that of first finding the *cross-distance* between Black Down and Dean Hill. To do this, we have the angle at Nine Barrow Down, between Black Down and Dean Hill, and the respective distances from the first to the latter stations, together with the newly observed angle between Dunnose and Nine Barrow Down; from which we obtain the angles of a triangle, constituted by Dunnose, Nine Barrow Down, and Black Down.

The distance from Nine Barrow Down to Dean Hill is 166497 feet, and, from the same station to Black Down, the distance is 126782 feet, (see Phil. Trans. for 1795, p. 502, and for 1797, p. 455,) and the angle comprehended by those distances = 110° 30′ 13″ ,25. The difference between the horizontal angle and that formed by the chords is 3″,25, which, substracted from 110° 30′ 13″,25, leaves 110° 30′ 10″: computing with this angle and the sides spoken of, there results the following triangle, viz.

Nine Barrow Down -	110° 30′ 10″
Black Down - -	40 6 54,75
Dean Hill - - -	29 22 55,75

This, using the side Nine Barrow and Dean Hill, (166497 feet,) gives 240236,7 feet, for the distance between Black Down and Dean Hill.

The angle at Dean Hill, between Nine Barrow Down and Dunnose, is 64° 50′ 19″, (see Phil. Trans. for 1795. p. 501,) and the angle between Black Down and Nine Barrow, as just found, is 29° 22′ 55″,75, which, increased by the proper correction for the difference between the chord and horizontal angles, becomes 29° 22′ 57″,5. The sum of these angles, 94° 13′ 16″,5, is the horizontal angle between Black Down and Dunnose.

The angle at Black Down, between Dunnose and Nine Barrow Down, deduced from observations made in 1797, is found to be 4° 30′ 25″,75: this, subtracted from the angle between Dean Hill and Dunnose, leaves 35° 36′ 29″, for the angle at Black Down; which, corrected for the purpose of reduction to their respective chord angles, become 94° 13′ 11″,5, and 35° 36′ 25″,75, from whence we get the angle at Dunnose = 50° 10′ 22″,75. We have, therefore, the following triangle, viz.

Dean Hill - - -	94° 13′ 11,5″
Black Down - -	35 36 25,75
Dunnose - - -	50 10 22,75

The distance between Dean Hill and Dunnose is 183496,2 feet, (Phil. Trans. for 1795, p. 501,) and that between Black Down and Dean Hill, according to the foregoing computation, is 240236,7 feet: these, applied to the angles of the above triangle, give 314309,6, and 314305,4 feet, respectively, for the distance between Black Down and Dunnose: wherefore, the mean 314307,5 feet, = 59,528 miles, may be considered as the true distance between those stations.

Direction of the Meridian at Black Down.

On the 18th of April, in the forenoon, the angle between the Pole Star, when at its greatest apparent elongation from the meridian, was observed, and found to be -	104° 19′ 19″,25
And on the 19th, in the afternoon -	98 42 47
Half their sum is the angle between the meridian and Abbotsbury staff - -	101 31 3
On the 20th of April, in the forenoon, the angle between the Pole Star, when at its greatest apparent elongation from the meridian, was observed, and found to be -	104 19 25,25
And on the 19th, in the afternoon -	98 42 35,5
Half their sum is the angle between the meridian and Abbotsbury staff - -	101 31 0,5

Therefore, 101° 31′ 2″ may be taken for the angle between the meridian and Abbotsbury staff.

ART. XVII.—*Latitude and Longitude of Black Down.*

The angle between Dunnose and the Abbotsbury Staff was observed, and found = 164° 26′ 35″25; and the angle between the meridian and the same staff, by double azimuths of the Pole Star, 101° 31′ 2″. Wherefore their sum, subtracted from 360°, leaves 94° 2′ 22″,75, the angle which Dunnose makes with the meridian.

In Fig. 4. Plate XXX. let Z be the zenith, B the station on Black Down, and ZBA its meridian; also, let D be Dunnose, and ZD its meridian; likewise, suppose BC to be an arc of a great circle, perpendicular to the meridian at B, and DA another arc of a great circle, perpendicular to the meridian at D, BF and ED being the parallels of latitude at Black Down and Dunnose.

In the spherical triangle BZD, the angles at B and D are given, the first being 94° 2′ 22″,75; and the second 84° 54′ 53″; therefore, in the triangle ABD the angle at B is 85° 57′ 36″,75, and, in the triangle BDC, the angle at D = 84° 54′ 53″: hence, the angles of these triangles, when reduced to those formed by the chords, are as follows:

$$\text{In the triangle BDC}\left\{\begin{array}{l}\text{DDC} = 84^\circ\ 54'\ 52{,}5''\\ \text{CDB} = 91\ \ 2\ \ 44{,}75\\ \text{CBD} = \ \ 4\ \ 2\ \ 22{,}75\end{array}\right.$$

$$\text{And in the triangle ABD}\left\{\begin{array}{l}\text{ABD} = 85\ \ 57\ \ 36{,}75\\ \text{BAD} = 88\ \ 57\ \ 16{,}25\\ \text{BDA} = \ \ 5\ \ 5\ \ 7\end{array}\right.$$

Now the distance between Black Down and Dunnose, BD, has been already found to be 314307,5 feet; therefore, using the above angles with that distance, (after the proper corrections are applied for reducing the horizontal angles to those formed by the chords,) we get,

$$\text{In the triangle BCD}\left\{\begin{array}{l}\text{BC} = 313128\\ \text{CD} = 21146{,}9\end{array}\right\}\text{feet.}$$

$$\text{And in the triangle ABD}\left\{\begin{array}{l}\text{AD} = 313581{,}2\\ \text{AB} = 27864{,}5\end{array}\right\}\text{feet.}$$

Again, in the two small triangles formed by the parallels BF and ED, the perpendiculars BC and DA, and the small arcs CF and AE, we have the angles at C and A given, the first being 91° 2′ 45″,75, and the last 88° 57′ 15″; which angles, however, are augmented by the addition of the differences between the horizontal angles and those formed by the chords. We have therefore,

$$\text{In the triangle BCF}\left\{\begin{array}{llll}\text{BCF} = 91^\circ & 2' & 45{,}75'' \\ \text{BFC} = 88 & 25 & 51{,}5 \\ \text{FBC} = 0 & 31 & 22{,}75\end{array}\right.$$

$$\text{And in the triangle AED}\left\{\begin{array}{llll}\text{EAD} = 88 & 57 & 17 \\ \text{AED} = 90 & 31 & 21{,}5 \\ \text{ADE} = 0 & 31 & 21{,}5\end{array}\right.$$

And, using BC and AD, as found above, we get

$$\left.\begin{array}{r}\text{CF} = 2859{,}1 \\ \text{And EA} = 2859{,}8\end{array}\right\}\text{feet.}$$

Therefore FD = DC + CF = 22146,9 + 2859,1 = 25006 feet. And BE = BA = EA = 27864,5 − 2859,8 = 25004,7 feet. The mean, 25005,3 feet, may be considered as very nearly the true distance between the parallels of Black Down and Dunnose. This method is the same as that made use of in the Phil. Trans. for 1795, p. 521, and affords the means of very accurately determining the distance between the parallels of latitude of the two stations, when the angles were observed with precision, and the direction in which the stations lie, is not much removed from east and west.

This small space, 25004,7 feet, corresponds to 4′ 6″,5, in which I use 60851 fathoms for the length of a degree of the meridian in 50° 41′. See Phil. Trans. for 1795, p. 537.

Now the latitude of Dunnose is 50° 37′ 7″,3, and its longitude 1° 11′ 36″; (Phil. Trans. for 1795, p. 536;) therefore, 50° 37′ 7″3 + 4′ 6″,5 = 50° 41′ 13″,8, is the latitude of Black Down.

This method of finding the latitude seems to be more correct than by spherical computation; yet, by this latter, nearly the same conclusion is derived; for, the bearing of Black Down west of Dunnose being 84° 54′ 52″,5, we get the distance of that station from the meridian of the latter = 313072 feet, and from the perpendicular, 27861 feet; which, converted into parts of an arch, according to the lengths of their respective degrees, gives 50° 41′ 14″ for the latitude, and 1° 20′ 46″,4 for the longitude west of Dunnose. According to the troublesome yet ingenious method recommended by M. SEJOUR, in his *Traité Analytique des Mouvemens apparens des Corps Célestes*, the latitude of Black Down comes out 50° 41′ 13″,9, and the longitude 1° 20′ 45″,75. We may, therefore, admitting the supposition of Dunnose being situated in 50° 37′ 7″,3, safely take 50° 41′ 13″,8 for the latitude, and 2° 32′ 22″,4 for the longitude, of Black Down; that of Dunnose being 1° 11′ 36″ west of the meridian of Greenwich.

ART. XVIII. *Calculation of the Distance between the Stations on Black Down, in Dorsetshire, and Rippin Tor, in Devonshire.*

For the calculation of this distance, we must have recourse to the XLVIIth, XLVIIIth, XLIXth, and Lth triangles. (See Philosophical Transactions for 1797, and Plate XXX, Fig. 1 of this Volume.) In the two first, we have the whole angle at Pilsden, between Dumpdon and Black Down = 152° 37′ 27″,25, which, reduced to the angle formed by the chords, becomes 152° 37′ 24″,25. The sides forming this angle, are Dumpdon and Pilsden, Pilsden and Black Down: the distance between the two first stations being 78459,3 feet, and between the two last 79110,7 feet. From these *data*, the distance between Dumpdon and Black Down is found to be 153095,7 feet, the triangle for computation being,

Pilsden - - 152° 37′ 24″,25
Black Down - - 13 37 50 ,5
Dumpdon - - 13 44 45 ,25

But this side may be also found, by computing with the whole angle at Charton Common, which angle, when reduced to the plane of the chords, becomes 141° 33′ 53″,75. The two sides are 581012,5 feet, and 103345 feet; which *data* give the following triangle:

Charton - - 141° 33′ 53″,5
Dumpdon - - 24 48 39 ,25
Black Down - - 13 37 27 ,25; from whence we find the distance from Dumpdon to Black Down = 153094,6 feet. Wherefore, the mean, 153095,2 feet, may be considered to be very nearly the true distance.

In the Lth triangle, (Cawsand Beacon, Dumpdon, and Little Haldon) the angle at Cawsand Beacon is 43° 14′ 21″,25; and in the LIst, (Rippin Tor, Cawsand Beacon, and Little Haldon) the angle at the same station is 25° 30′ 39″,75; their sum is 68° 45′ 1″, and, adding 1″ for the necessary correction, it becomes 68° 45′ 2″. Computing with this angle, and the including sides, (64020,5 and 18334 feet,) we obtain the following triangle:

Rippin Tor - - 90° 34′ 35″
Cawsand Beacon - 68 45 2
Dumpdon - - 20 40 23, which gives the distance from Dumpdon to Cawsand Beacon = 169014 feet.

In the XLIXth triangle, the observed angle at Dumpdon is found to be 86° 39′ 8″5, and, by adding to it the horizontal angle at Dumpdon, between Rippin Tor and Little Haldon, and also that between Black Down and Charton Common, we get 125° 54′ 30″,5, for the horizontal angle between Rippin

Tor and Cawsand Beacon. To reduce this angle to that formed by the chords, 6″ must be subtracted; therefore, 125° 54′ 24″,5 is the angle for computation. The sides Dumpdon and Rippin Tor, Dumpdon and Black Down, (169014 and 153095,2 feet,) with this angle, give the following triangle:

Rippin Tor - - 25° 36′ 4″,5
Dumpdon - 125 54 24,5
Black Down - 28 29 31, which gives the distance from Rippin Tor to Black Down = 286973,3 feet.

On referring to the observations made in 1797, on Black Down, it will be seen that the angle between Rippin Tor and the staff erected near Abbotsbury, was 3° 8′ 52″,5, and the angle between Pilsden and the same staff 45° 16′ 13″; their difference, 42° 7′ 20″,5, is the angle between Rippin Tor and Pilsden. Now, if the angles of the triangles, five in number, used in finding the distance between Rippin Tor and Black Down have been observed correctly, and the calculations properly made, the computed angle at Blackdown, between those stations, should be, of course, the same; but the angle formed by the chords of the arcs between Blackdown and Pilsden and Dumpdon, has been found = 13° 37′ 50″,5, (which is very nearly the same as the horizontal one,) and the angle between Dumpdon and Rippin Tor = 28° 29′ 31″, which it is also unnecessary to correct: their sum is 42° 7′ 21″,5, the very angle observed. It is not, perhaps, proper to dismiss this consideration, without observing that this agreement affords a strong proof of the excellence of our instrument, as the triangles, from their magnitude and nature, are not so disposed as to favour the comparison. - - - - -

ART. XIX. *Latitude and Longitude of Rippin Tor.*

The angle at Blackdown, between the staff at Abbotsbury and the meridian, has been found = 101° 31′ 1″,5, nearly, and that between Rippin Tor and the same staff = 3° 8′ 52″,5; therefore, 98° 22′ 8″ is the angle which Rippin Tor makes with the meridian, and this, taken from 180°, leaves 81° 37′ 52″, the bearing of Rippin Tor SW from Black Down.

This angle, with the distance found above, gives 28585,3 feet, for the distance of Rippin Tor from the meridian of Black Down, and 56086,0 feet, for that from its perpendicular; therefore, the latitude is 50° 33′ 59″,1, and the longitude west from Black Down, 1° 13′ 3″,8; consequently, its longitude west of Greenwich is 3° 45′ 26″2.

Direction of the Meridian at Butterton Hill.

On the 6th of May, in the afternoon, the angle between the Pole Star, when at its greatest apparent elongation from the meridian, and the staff on Hemmerdon Ball was observed, and found to be - - - - - -	91° 29′ 13″75
And on the 7th, in the afternoon - -	97 4 14
Half their sum is the angle between the meridian and the staff on Hemmerdon Ball -	94 16 44
Again, on the 7th, in the afternoon, the angle between the Pole Star, when at its greatest apparent elongation from the meridian, and the staff on Hemmerdon Ball was observed, and found to be - - - - -	91 29 12

Half the sum of this, and the angle observed

in the forenoon of the same day, (97° 4′ 14″)
is - - - - - - 94° 16′ 43″

Hence, 94° 16′ 44″ may be considered as the true angle between the meridian and the staff on Hemmerdon Ball.

The angle between the station on Rippin Tor and Hemmerdon Ball, is 121° 17′ 7″,75; therefore, 121° 17′ 7″,75 — 94° 16′ 44″ = 27° 0′ 23″,75, is the bearing of Rippin Tor, north-east of Butterton. This angle, with 62951 feet, gives 28585,2 feet, and 56086,6 feet, for the distance of Rippin Tor from the meridian and perpendicular; which, using 61182 and 60847 fathoms, for the lengths of degrees on the meridian and perpendicular, respectively become 4′ 40″,3, and 9′ 13″. Therefore, in the right angled spherical triangle BPT, (Plate XXX, Fig. 2,) in which B is Butterton, P the pole, T Rippin Tor, and R the point where the parallel to the perpendicular cuts the meridian, we have the co-latitude of T, or Rippin Tor, = 39° 26′ 0″,9, and RT = 4′ 40″,3, We have, consequently, cosine 4′ 40″,3 : radius : : cosine 39° 26′ 0,″9 : cosine 39° 26′ 0,″7, the co-latitude of the point R. So PB = PR + RT = 39° 26′ 0″,7 + 9′ 13″ = 39° 35′ 13″,7; therefore, the latitude of Butterton is 50° 24′ 46″,3, and its longitude west from Greenwich, 3° 52′ 47″,5.

Art. xx. *Calculation of the Distance between Hensbarrow and Butterton.*

The most convenient, as well as the most accurate means of computing this distance, will be by referring to the lvith, lviith, and lxivth triangles, in the series of 1796, where the sum of the observed angles at Carraton Hill is 136° 52′ 43″. The correction for reducing this angle to that formed by the chords, is 4″; therefore, 136° 52′ 39″ is the proper angle for computation.

The distance from Hensbarrow to Carraton Hill, is 100416 feet, and from Butterton to that station 131576 feet. (See Phil. Trans. for 1797, p. 458, 460.) These *data* give the following triangle, viz.

Carraton Hill - -	136° 52′ 39″
Hensbarrow - -	24 35 57,5
Butterton - -	18 31 23,5,

which gives 21602 feet, for the distance between Hensbarrow and Butterton Hill.

The angle between Carraton Hill and Rippin Tor was observed in 1796, and found = 101° 3′ 44″,25. (See Phil. Trans. 1797.) The angle between Hensbarrow and Rippin Tor is 119° 35′ 3″,25; therefore, 18° 31′ 19″ is the angle between Hensbarrow and Carraton. The difference between the horizontal and chord angle is 0″,25 nearly; this, added to 18° 31′ 23″,5, gives 18° 31′ 23″,75, which is nearly the same as the observed angle. This agreement proves, that the angles of the triangles connecting Butterton and Hensbarrow have been observed correctly.

ART. XXI. *Latitude and Longitude of Hensbarrow.*

The angle between Hensbarrow and Hemmerdon, (see Observations made at Butterton,) was 1° 52′ 4″,5; therefore, as the angle between the latter and the meridian = 94° 16′ 44″, we get 92° 24′ 39″,5, for the angle which Hensbarrow makes with the same meridian. The distance from Hensbarrow to Butterton, as found above, is 21602 feet; this, with the angle 92° 24′ 39″,5, gives the distance of Hensbarrow from the meridian = 215871 feet, and from the perpendicular 9689 feet; these, converted into parts of degrees, become 35′ 17″,1, and 1′ 29″,62. Therefore, the latitude of Hensbarrow is 50° 23′ 3″,3, and its longitude, west of Butterton, 55′ 20″,2; consequently, its longitude, west of Greenwich, is 3° 52′ 47″,5 + 55′ 20″,2 = 4° 48′ 7″,7.

ART XXII. *Direction of the Meridian at St. Agnes Beacon.*

On the 22d of May, in the forenoon, the angle between the Pole Star, when at its greatest elongation from the meridian, and the staff near Peranzabulo, was observed, and found to be - - - - - -	38° 26′ 1″,5
And on the 22d, in the afternoon -	44 0 33,25
Half their sum is the angle between the meridian and staff - - -	41 13 17,5

The angle between the staff at Peranzabulo and the station Hensbarrow, was also observed at the same station, and found to be 31° 50′ 55″,5; wherefore, 41° 13′ 17″,5 + 31° 50′ 55″,5 = 73° 4′ 13″, is the angle between Hensbarrow and St. Agnes Beacon.

ART. XXIII. *To find the Latitude and Longitude of St. Agnes Beacon.*

In Plate XXX. Fig. 3. Let A be the station at St. Agnes, P the pole, H Hensbarrow, and B the point where the parallel to the meridian of St. Agnes cuts that meridian, BHP being a right angled spherical triangle on the earth's surface.

PH has been already found = 39° 36′ 56″,7; and, as BH, the distance of Hensbarrow from the meridian, = 92878, and AB, the distance from the perpendicular, = 28271, we get BH = 15′ 10″,9, and AB = 4′ 38″,8; which arcs are found by using 61182 and 60845 fathoms, for the length of their respective degrees. From these *data*, the latitude of the point B is easily derived; for cosine $15' \, 10'',9$: radius : : cosine $39^\circ \, 36' \, 56'',7$: cosine $39^\circ \, 36' \, 54'',2$, the co-latitude of B; hence $39^\circ \, 36' \, 54'',2 + 4' \, 38'',8 = 39^\circ \, 41' \, 33'',0$ the co-latitude of A; hence $50^\circ \, 18' \, 27''$ is the latitude of St. Agnes. Its longitude, west from Hensbarrow, is also found by a simple proportion; sine $39^\circ \, 36' \, 54'',2$: radius : : sine $15' \, 10'',9$: sine $0^\circ \, 23' \, 48''$; therefore, $4^\circ \, 48' \, 7'',7 + 0^\circ \, 23' \, 48'' = 5^\circ \, 11' \, 55'',7$, is the longitude of St. Agnes, west of Greenwich.

ART. XXIV.—*Remarks.*

I have shewn, with attention to minuteness, the manner in which the latitudes and longitudes of the stations on which directions of meridians have been observed are determined. It now remains to be considered, how far the uncertain state in which we remain, with respect to the figure of the earth, may affect the accuracy of those conclusions.

If the earth were homogeneous, it would necessarily be an ellipsoid; and, were its diameters known, the longitudes and latitudes of places on its surface might be accurately computed, provided their geodetical situations were correctly ascertained, and the latitude of one station in the series of triangles truly determined.

As there is, however, great reason to suppose that the earth is not any regular geometrical figure, from the impossibility of reconciling the results of the various measurements for ascertaining the lengths of degrees of latitude, some uncertainty must remain with respect to our deductions; but there seems to be reasons for supposing the errors, thence resulting, are confined within moderate limits.

In making computations on a given hypothesis of the earth's figure, the truth of the conclusions, as well as the ease with which they are found, materially depends on the distances of the objects from their respective fixed meridians.

If the difference of longitude approaches nearly to, or exceeds 3°, to compute that longitude, and also the latitude, it is necessary the precise figure should be understood; because the analogy does not hold good, in that case, between the equality of the sums of the angles of spherical and spheroidical triangles on the earth's surface. With regard to latitudes, more particularly when the distances are diminished by means of frequent new directions of meridians, a knowledge of the exact length of a degree of a great circle is not necessary; because the determination of those latitudes, by means of spherical computation, being true as to sense, the cosines of those small arcs will remain the same.

As there cannot be a doubt justly entertained of the latitude of Greenwich being very accurately determined, as particularly set forth by the Astronomer Royal in his reply to M. CASSINI, it is reasonable to suppose, that if any errors do exist in the latitudes of those stations, they can only have arisen from the computations being made with erroneous lengths of degrees on the meridian.

In our former Papers on this subject, we have taken it for granted, that the length of a degree of the meridian at the middle point between Greenwich and Paris, (50° 10′,) is 60842 fathoms, (which supposition may be considered just, provided the latitude of Paris, 48° 50′ 14″, be as near the truth as 51° 28′ 40″ is to that of Greenwich,) and afterwards added 9 fathoms, making it 60851, in order to get the length of the degree in 50° 41′; (see Phil. Trans. 1795, p. 537;) these 9 fathoms, however, were not arbitrarily assumed, but computed. If the latitude of Paris be 48° 50′ 15″, (*Conn. des Tems*, 1797-98, p. 373,) the length of the degree will be about 7 fathoms greater, which will make the degree in 50° 41′, 60849 instead of 60842 fathoms.

The latitude of the station on Beachy Head, 50° 44′ 23″,7, was found by using 60861 fathoms for the length of a degree on the meridian in 51° 6′; but, if it be true that 48° 50′ 15″ is the latitude of Paris, the latitude of Beachy Head will be about one-third of a second greater. This seems to be the limit of the probable error in the computed latitude of this station; since its proximity to the meridian of Greenwich, obviates any doubt of the conclusions being affected by any uncertainty respecting the length of the degree of the great circle perpendicular to the meridian.

The latitude of Dunnose was determined by computing the distance between the parallels of that station and Beachy Head; (see Phil. Trans. for 1795, p. 522;) which method is very exact, and preferable to any other, since the small space between the parallels was determined with great accuracy, leaving not a doubt of a greater error than 3 feet, a quantity corresponding to about $\frac{1}{33}$d part of a second. And, since the same method has been adopted to find the difference of latitude between Black Down and Dunnose, it is highly probable that the latitude of the former station is not removed more than $\frac{3}{10}$ths of a second from the true one, that of Beachy Head being supposed = 50° 44′ 23″,7.

It would have been fortunate, had the difference of latitude between Black Down and Butterton, and Butterton and St. Agnes Beacon, been determined in the same manner, since the latitudes of all these important stations would, in that case, have been found with evident accuracy; but, whoever has leisure and inclination to go through these calculations, will find that, by means of the directions of meridians at Butterton and St. Agnes Beacon, the latitudes of those stations may be found to within half a second. By this I mean, that, allowing the latitude of Black Down to be 50° 41′ 13″,8, the latitude of Butterton, 50° 24′ 46″,3, will not deviate more than half a second from the truth; and the same may be said with respect to the latitude of St. Agnes, that of Butterton being admitted as correct. Supposing, therefore, the latitude of Greenwich to be 51° 28′ 40″, we may rely on the assurance of the latitude of St. Agnes Beacon being determined within $1\frac{1}{2}''$ of the truth.

With respect to the longitudes of these stations, their accuracy entirely depends on the observations made at Dunnose and Beachy Head, for determining the length of a degree of a great circle perpendicular to the meridian. The truth of the deduction drawn from those observations rests on their accuracy; and it can scarcely be deemed presumptuous to assert, that an error of more than 1″ cannot have existed in either of the angles. On this account, therefore, I should suppose, that the difference of longitude between those stations, has been found so nearly as to leave no greater error than 1″. The whole of the operation to which I now allude, was performed with great care; the directions of the meridians having been determined by means of double azimuths of the Pole Star, confirmed by computed azimuths. In returning to the consideration of this subject, I do not perceive any source of error likely to affect the conclusions, unless it be that to which all astronomical observations, made with instruments adjusted by plumb-lines or levels, are liable. In determining differences of longitude through these means, the direction in which any lateral attraction must act, to produce *a maximum* of error, is at right angles to the meridian. If the attraction be *in the plane of it,* it is obvious the double azimuth, although the telescope of the theodolite does not move in a vertical, will nevertheless give, almost exactly, the true direction of the meridian.

The high lands about St. Catherine's Light-House, in the Isle of Wight, are about six miles from Dunnose, and nearly west of it; but it does not appear that the effect of their lateral attraction can have produced any sensible error; since it may be shewn, that the plumb-line of the sector at Schehallien would have deviated only a small part of a second from the true vertical, had the sector itself been placed at that distance from the hill. Beachy Head is situated at the eastern extremity of the South Downs; *a defect* of matter towards the east immediately taking place. This circumstance renders the observations liable to some small errors, on account of the superior lateral attraction in the opposite direction; but, notwithstanding it is very probable that an error induced by either of these attractions, is so very small as to render the subject scarcely worth consideration, yet, as both lie *the same way,* it is satisfactory to consider that they mutually tend to correct the errors which may result from either; we may, therefore, safely conclude, that 1° 11′ 36″ is very nearly the true longitude between the station on Beachy Head and that on Dunnose. Under this persuasion, I consider it probable that the longitude of Black

Down cannot err in excess or defect more than 3″; that of Butterton 5″; and that of St. Agnes Beacon 6″.

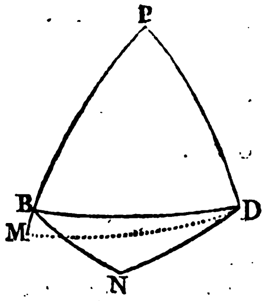
The latitudes and longitudes of these important stations, brought under one point of view, will be as follows:

	Latitude.	Longitude west from Greenwich.	
		In degrees.	In time.
Black Down -	50° 41′ 13″,8	2° 32′ 22″,4	10′ 9″,5
Butterton Hill -	50 24 46,3	3 52 47,5	15 31,2
St. Agnes Beacon	50 18 27	5 11 55,7	20 47,7

Note. It may probably be expected, that I should determine the directions of the meridians at Black Down, Butterton Hill, and St. Agnes Beacon, by calculation, and afterwards compare them with the observed ones. I have desisted from the measure in the body of the work, and reserved the little I have to say for this note.

If the earth were a perfect sphere, or an ellipsoid of known diameters, the direction of the meridian, at any station not very remotely situated from the parallel of another, might be determined, provided the direction of the meridian at that station were observed, and the value of the arc subtended by the space between them pretty accurately ascertained, and also the latitude of the station, at which the angle is given, nearly obtained.

Thus, if it be required to find the angle at Dunnose, between Beachy Head and the meridian, from the observed angle at the latter station, and the arc between them, we shall have 39° 15′ 36″,5, the co-latitude of Beachy Head, and 55′ 28″,7 for the oblique arc. These *data* (two sides and an included angle) give 1° 26′ 48″,4, for the difference of longitude between Beachy Head and Dunnose, and 81° 56′52″,6, for the angle which the meridian at the latter makes with the former station. The difference of longitude found in a rather more correct way, has been heretofore shewn to be 1° 26′ 47″,93, (see Philos. Trans. 1795. p. 523,) and the angle at Dunnose was also shewn to be 81° 56′ 53″, from observation, which may be considered the same with that found by this mode of computation. In all cases in which the *data* were equally correct, no doubt the direction of meridians might be computed, without fear of the results deviating much from the truth; but, if it be required to find the angle at Black Down, from the observed direction of the meridian at Dunnose, a different method must be used. It is, however, less accurate than the former one, and it has been expressly for this reason, that I have not introduced this subject into the account.



In the adjoining diagram, suppose B, Black Down; D, Dunnose; and, N, Nine Barrow Down: also, let PB, the meridian of Black Down, be prolonged to M, and DM be drawn, PM being = PD. Then we shall have three spherical triangles BPD, BND, and BMD. Now, the angle NBD was found from observations to be 4° 30′ 28″, and BND 172° 27′ 33″,5; these give the angle BDN = 3° 1′ 59″,5, nearly, because the excess of the three angles above 180° is 1″. The observed angle at D, Dunnose, between Nine Barrow Down and the meridian DP, or PDN, was 87° 56′ 53″; therefore, 87° 56′ 53″ — 3° 1′ 59″,5 = 84° 54′ 53″,5, is the angle at D, between the meridian and the station on Black Down.

Now, the difference of longitude between B and D, or the angle at P, has been already found = 1° 20′ 46″,4; and, since BP is very nearly = PD, and BD is small, we shall have rad. : tang. $\frac{1}{2}$P :: cosine DP : cosine BMD = 89° 28′ 47″. But the angle PDB has been found = 84° 54′ 53″,5; therefore, 89° 28′ 47″ — 84° 54′ 53″,5 = 4° 33′ 53″,5, the angle BDM; hence, 180° 0′ 2″ — 94° 2′ 40″,5 = 85° 57′ 21″,5, or MBD; therefore, 94° 2′ 38″,5, or DBP, is the angle at Black Down obtained in this way, which differs nearly 16″ from the observed one, viz. 94° 2′ 22″,75. It is probable, some portion of this arises from defects in the observation made at Dunnose, on the lights fired at Nine Barrow Down: only two lights were seen; and, as the observations differed 5″ from each other, some degree of doubt exists, as to the accuracy of the angle. The angle at Nine Barrow Down, between Black Down and Dunnose, is not absolutely to be depended on for purposes of this kind, although there can be no doubt of its being sufficiently near the truth, for that to which it has been before applied. In the correction of the angles at that station, in our former accounts, we proceeded on the supposition of their being less satisfactory than the other angles of the triangles to which Nine Barrow Down is a common station. For these reasons, I am of opinion the computed angle cannot be applied as a test to the observed one; and it also appears to me, that greater objections lie against similar comparisons between the computed and observed angles at Butterton and St. Agnes; as those stations could not be seen from each other, nor the latter from Black Down. Although the computed directions of the meridians differ some seconds from the observed ones, I am by no means doubtful of the truth of the latter; as the double azimuths of the Pole Star, found from computation, agree very satisfactorily with those which have been used in obtaining the directions of the several meridians.——In finding the value of the oblique arc, or the line which joins Black Down and Dunnose, as used in the first method of computation, I have had recourse to the following *correct* expression, viz. $d = \frac{p\,m}{p + m - p \cdot s^2}$; where d is the length of the required degree, p that of the great circle perpendicular to the meridian, m that of a degree of the meridian itself, and s the sine of the angle constituted by the oblique arc and the meridian.

Art. XXV. *Bearings of the Stations in the Series of 1795 and 1796, from the Parallels to the Meridians of Black Down, Butterton Hill, and St. Agnes Beacon; likewise their Distances from those Meridians, and from their Perpendiculars.*

Meridian of Black Down.

Bearings from the Parallel to the Meridian.						Distances from merid.	Distances from perp.
		°	′	″		Feet.	Feet.
Bull Barrow	Black Down	42	2	30	N E	53643,2	59489,7
Mintern		10	36	33	N E	10996,8	58709
Pilsden		56	14	48	N W	65775,6	43955,4
Charton Common		83	30	3	N W	102681	11697,5
Dumpdon	Charton Common	45	4	0	N W	143749	52670,9
Rippin Tor		81	37	52	S W		

Meridian of Butterton.

Rippin Tor	Butterton	27	0	23	N E	28585,3	56086,6
Furland		78	37	39	S E	78966,3	15883
Bolt Head		14	49	48	S E	18551,3	70065,4
Maker Heights		70	36	9	S W	71467,9	25164,3
Kit Hill		67	12	12	N W	93081,9	39121,7
Carraton Hill		73	53	22	N W	126408,9	36511,3
Cawsand Beacon	Rippin Tor	35	35	29	N W	86744,4	108147,5
Little Haldon	Furland	4	25	2	N E	84571,4	56676,8
Bindown	Maker	70	4	48	N W	52926,6	19180,1
Hensbarrow		87	35	18	S W	92878,0	28271,0

Meridian of St. Agnes Beacon.

Hensbarrow	St. Agnes Beacon	73	4	13	N E	92877,4	28279,9
Deadman		72	24	27	S E	97292,5	30849
Karnbonellis		3	27	27	S W	2741,7	45379,2
Karnminnis		61	13	58	S W	74168,1	40719
Bodmin	Hensbarrow	37	30	45	N E	121703,2	65825,8
Lansallos		75	29	51	S E	152945,3	12733,5
St. Burian	Karnborellis	67	20	59	S W	94831,5	83807,3
Pertinney	Karnminnis	39	25	32	S W	100465,1	72704,4
Sennen	Pertinney	40	50	18	S W	113674,4	879868

ART. XXVI. *Latitudes and Longitudes of the Stations in the Series of 1795 and 1796.*

Meridian of Black Down.

Names of Stations.	Latitude.	Longitude from Black Down.	Longitude west of Greenwich.	
			In degrees.	In time.
	° ′ ″	° ′ ″	° ′ ″	m. s.
Bull Barrow	50 50 59,5	0 13 53,2 E	2 18 29,2	9 14
Mintern	50 50 52,8	0 2 50,8 E	2 29 31,6	9 58,1
Pilsden	50 48 26,9	0 17 0,7 W	2 49 23,1	11 17,5
Charton	50 43 6,1	0 26 30,5 W	2 58 52,9	11 55,5
Dumpdon	50 49 47,2	0 37 12,1 W	3 39 34,5	14 38,3
Rippin Tor	50 33 59,1	1 13 3,8 W	3 45 26,2	15 1,7
Meridian of Butterton Hill.		From merid. of Butterton.		
Furland	50 22 7,8	0 23 13,2 E	3 32 34,3	14 10,3
Little Haldon	50 34 3,0	0 21 45,6 E	3 31 1,9	14 4,1
Cawsand Beacon	50 42 31,14	0 2 14,3 W	3 55 1,8	15 40,1
Bolt Head	50 13 15,2	0 4 44,5 E	3 48 3,1	15 12,2
Maker	50 20 36,56	0 18 18,2 W	4 11 5,7	16 44,3
Kit Hill	50 31 9,4	0 23 55,7 W	4 16 43,2	17 6,9
Carraton Hill	50 30 41,6	0 32 29,5 W	4 25 17,0	17 41,1
Bindown	50 23 32,9	0 31 53,5 W	4 24 41,0	17 38,7
Hensbarrow	50 23 3,3	0 55 20,2 W	4 48 7,7	19 12,5
Meridian of St. Agnes.		From merid. of St. Agnes.		
Lansallos	50 20 25,7	0 39 10,3 E	4 32 45,7	18 11,0
Bodmin Down	50 29 11,6	0 31 15,9 E	4 40 39,8	18 42,6
Deadman	50 13 20,0	0 24 51,3 E	4 47 4,4	19 8,3
Karnbonellis	50 10 59,4	0 0 42,0 W	5 12 37,7	20 50,5
Karnminnis	50 11 43,8	0 18 56,2 W	5 30 51,9	22 3,5
St. Burian	50 4 37,9	0 24 9,2 W	5 36 4,9	22 24,3
Pertinney	50 6 27,0	0 25 36,2 W	5 37 31,9	22 30,1
Sennen	50 3 55,6	0 28 56,7 W	5 40 52,4	22 43,5

Art. XXVII. *Bearings of the intersected Objects, from the Stations in the Series of 1795 and 1796, from the Parallels to the Meridians of Black Down, Butterton Hill, and St. Agnes Beacon; and likewise their Distances from these Meridians.*

Meridian of Black Down.

Bearings from the Parallels to the Meridian.					Distances from merid.	Distances from perp.
At Bull Barrow.	°	′	″		Feet.	Feet.
Portland Light House	19	47	16	S E	21581	59985
Noil Windmill	10	12	56	N E	72842	166029
Noil Steeple	21	53	29	N E	86610	141534
Holy Trinity, Shaftsbury	25	41	52	N E	81081	116506
St. Rumbold's Steeple, Ditto	28	12	51	N E	80486	109522
Maypowder Steeple	85	17	11	N W	29526	61479
Stourhead House	0	27	46	N W	52881	153806
Mr. Frampton's Obelisk	10	3	4	S E	63588	3384
Mere Steeple	6	40	55	N E	63893	146984
Mrs. Thornhill's Obelisk	22	18	51	N W	40391	91778
Odcomb Spire	70	25	0	N W	35474	91194
Milborne Port	38	21	20	N W	20110	101865
At Black Down.						
Puncknoll Flagstaff	89	9	57	N W	25612	373
Lambert's Castle	65	17	36	N W	67269	30950
Lyme Cobb	82	21	29	N W	89547	12015
At Pilsden.						
Golden Cape	4	44	3	S W	68239	14209
Glastonbury Tor	14	19	23	N E	34314	167176
Bridport Beacon	8	19	55	S W	72199	91
Lord Rolle's Barn, near Sidmouth	64	34	38	S W	101743	26859
At Dumpdon.						
Naval Flagstaff, Whitlands	32	45	10	S E	116249	9920
Catherstone Lodge	2	29	45	N E	140940	117131
Lord Lisburne's Obelisk	46	47	34	S W	225502	24119
Sir J. de la Pole's Flagstaff	52	3	42	S E	86622	8137
Honiton Steeple	12	24	9	S W	146681	39339
St. Mary Ottery Steeple	42	21	56	S W	179904	13028
Sir Robert Palk's Tower	58	56	2	S W	242012	6526

Meridian of Butterton.

Bearings from the Parallels to the Meridian.					Distances from merid.	Distances from perp.
At Little Haldon.	°	′	″		Feet.	Feet.
North Bovey	71	44	23	N W	43315	70289
Eastern Karn	56	27	52	N W	41145	85459
Western Karn	53	12	10	N W	40730	89472
West Down Beacon	63	59	14	N E	126152	76968
Woodley's Summer House	83	39	47	S W	29448	50555
Berry Head Flagstaff	10	22	16	S E	95740	4350
Brixen Steeple	2	29	4	S E	87435	9331
Ipplepen Steeple	22	15	0	S W	68413	17180
Three Barrow Tor	68	43	3	S W	8667	27109
Brent Beacon	56	11	17	S W	15460	10390
At Butterton.						
Chudleigh Steeple	44	4	44	N E	67688	69900
Froward Flagstaff	75	0	28	S E	84342	22587
Start Point Flagstaff	39	22	33	S E	56544	68897
Marlborough Steeple	16	42	32	S E	18429	61393
Bolt Head Flagstaff	14	57	7	S E	18739	70173
Mewstone, highest point	52	35	23	S W	49825	38108
Cupola, Hospital, Plymouth	76	47	30	S W	66891	15699
St. John's Steeple	79	34	44	S W	83991	15447
Saltash Steeple	89	37	12	S W	73707	489
Penlee Beacon	64	59	49	S W	69758	32532
Plymstock Steeple	73	46	15	S W	49217	14326
Statten Barn	64	43	53	S W	53270	25145
Mount Batton	70	50	51	S W	58651	20370
Flagstaff, Plymouth Garrison	72	51	17	S W	57021	17591
New Church, Plymouth	75	25	49	S W	56521	14691
Old Church, Plymouth	75	1	56	S W	57505	15374
West Chimney, Governor's House	75	42	15	S W	64497	16435
Flagstaff on Mount Wise	75	40	55	S W	65281	16662
Chapel, Plymouth Dock	77	33	28	S W	67040	14792
Obelisk, Crimhill Passage, Plymouth	74	7	9	S W	66728	18984
Mount Edgecumbe House	72	18	23	S W	65827	21001
Flagstaff, Maker Tower	70	53	41	S W	68224	23632
Naval Signal Staff, Maker Tower	70	54	3	S W	68232	23626
Eddystone Light House	46	1	27	S W	87190	84127
At Butterton.						
Stonehouse Steeple	65	32	37	S W	53078	24140
Puslinch Obelisk	45	17	46	S W	27480	27223
Flagstaff, Rame Head	65	3	44	S W	76935	35774
At Rippin Tor.						
Great Haldon	52	27	0	N E	72023	89479

Bearings from the Parallels to the Meridian.	°	′	″		Distances from merid.	Distances from perp.
At Maker.					Feet.	Feet.
Hemmerdon Ball	62	10	37	N E	27722	2077
Brent Tor	5	27	45	N E	62385	69820
Blockhouse Flagstaff	27	51	26	N E	64005	11043
Rame Steeple	20	20	12	S W	74388	33043
Chapel, Dockyard	23	6	50	N E	67042	14795
Flagstaff, Statten Battery	88	9	5	S E	54278	25719
Windmill, Plymouth Dock	29	47	35	N E	65963	15549
At Kit Hill.						
St. Stephen's Steeple	19	29	31	S E	78182	2979
St. Ive Steeple	56	20	4	S W	114213	25947
Callington Steeple	43	0	14	S W	98219	33613
Linkinghorn Steeple	69	8	31	N W	111417	46108
St. Dominic Steeple	27	19	41	N E	89512	46030
South Petherwin Steeple	34	6	18	N W	115216	71807
South Hill	74	57	40	N W	108044	43142
St. Cleer Steeple	74	42	9	S W	133492	27795
At Carraton Hill.						
Cheese Rings	44	0	29	N W	133198	43540
Liskeard Steeple	15	19	39	S W	132155	15546
Landrake Steeple	46	1	2	S E	92463	3750
Duloe Steeple	15	23	3	S W	137923	5336
Menheniot Steeple	11	59	44	S E	121941	15479
Polparrow Flagstaff	20	8	5	S W	138871	2521
Lord Camelford's Obelisk	48	33	15	S W	163992	3324
Boconnock Steeple	44	34	58	S W	158753	3692
Roach Steeple	66	30	33	S W	218318	3434
Roach Rock	65	58	15	S W	217204	3969

Meridian of St. Agnes.

	°	′	″			
At Lansallos.						
Lanlivery Steeple	56	48	14	N W	119848	34388
Helmen Tor	53	55	17	N W	113818	41243
Mr. Tremaine's Summer House	67	21	40	S W	96548	10787
Gorran Steeple	58	55	59	S W	95877	21647
Flagstaff, Deadman	51	46	44	S W	97059	31278
Gwineas Rocks	53	9	0	S W	106551	22037
At Hensbarrow.						
Hendellion Steeple	2	26	59	N W	89918	97463
Stone, St. Braeg's Down	17	31	12	N W	81868	63145
St. Dennis Steeple	83	6	25	N W	77630	30114
Lansallos Steeple	73	43	28	S E	149787	116562
Gerrans Steeple	26	33	53	S W	55357	46773
St. Michael Carhayes Steeple	9	39	51	S W	84768	19353

Bearings from the Parallels to the Meridian.					Distances from merid.	Distances from perp.
	°	′	″		Feet.	Feet.
St. Kivern Steeple - -	27	6	7	S W	30611	93398
Flagstaff, Blackhead - -	24	50	36	S W	31214	104917
Windmill, near Fowey - -	67	2	44	S E	134347	10707
Menabilly House - -	60	26	48	S E	123516	10899
Old Tower at Polruan - -	64	44	37	S E	35892	7978
Flagstaff, St. Anthony's Head (D.*)	26	35	45	S W	48664	60038
At the Deadman.						
St. Veep's Steeple - -	39	4	29	N E	140146	21930
At St. Agnes.						
St. Columb Minor Steeple -	44	7	57	N E	40698	41950
Peranzabulo - - -	41	54	34	N E	19354	21563
St. Eval Steeple - - -	37	52	39	N E	50275	64632
Cubert Steeple - - -	42	26	53	N E	23773	25991
Flagstaff, Pendennis Castle - -	34	19	23	S E	39999	58586
Windmill, St, Mawe's - -	45	52	9	S E	48079	46642
Karnbre Castle - - -	11	53	47	S W	6480	30760
Illugan Steeple - -	30	1	2	S W	11865	20537
St. Paul's Steeple - -	20	21	16	S W	38457	103660
Lord Dunstanville's House -	40	33	25	S W	19726	23050
Gwinear Steeple - -	39	33	34	S W	39578	47911
Cow and Calf - - -	23	7	32	N E	37174	87044
Camborn Steeple - -	30	16	51	S W	19881	34048
St. Erme Steeple - -	88	42	22	N E	44657	1009
St. Allen Steeple - -	85	13	35	N E	36688	3064
Ludguan Steeple - -	47	39	58	S W	64737	58976
At Karnbonellis.						
Lizard Windmill - -	1	47	24	S E	573	114785
Grade Steeple - -	6	41	17	S E	5710	117451
Ruan Major Steeple - -	3	46	21	S E	1486	109496
St. Hilary Steeple - -	66	19	33	S W	49009	65664
Mr. Rogers's Tower, near St. Ives -	83	43	6	S W	18396	47102
Madern Steeple - -	76	53	40	S W	81542	63725
Parklough Flagstaff - -	6	55	11	S W	10735	111240
At Karnminnis.						
St. Buryan Steeple - -	25	45	25	S W	95205	84320
At St. Buryan.						
Chapel Karnbury - -	3	25	16	N W	95472	73098
Flagstaff, St. Leven's Point -	77	29	40	S W	114449	88158
Sennen Steeple - - -	83	44	37	S W	112202	85712
At Pertinney.						
Stone, LAND'S END - -	48	5	30	S W	116222	86847

* The letter D is added (as in the former accounts) to those places respecting which any doubts are entertained.

ART. XXVIII. *Latitudes and Longitudes of such intersected Objects, in the Series of* 1795 *and* 1796, *as have been referred to the Meridians of Black Down, Butterton Hill, and St. Agnes.*

Names of Objects.	Latitude	Longitude from Black Down.	Longitude west of Greenwich. In degrees.	In time.
	° ′ ″	° ′ ″	° ′ ″	m. s.
Portland Light House -	50 31 22,2	0 5 32,9 E	2 26 49,5	9 47,3
Noil Windmill - -	51 8 29,3	0 18 58,7 E	2 13 23,7	8 53,6
Noil Steeple - -	51 4 27,1	0 22 31,8 E	2 19 50,6	9 19,3
Holy Trinity, - Shaftsbury	51 0 20,7	0 21 3,6 E	2 11 18,8	8 45,3
St. Rumbold's Steeple, Ditto	50 59 11,8	0 20 53,9 E	2 11 28,5	8 45,8
Maypowder Steeple -	50 51 19,7	0 7 38,6 E	2 24 43,8	9 38,9
Stourhead House - -	51 6 29,5	0 13 46,0 E	2 18 36,4	9 14,4
Mr. Frampton's Obelisk -	50 41 46,0	0 16 24,5 E	2 15 57,9	9 3,8
Mere Steeple - -	51 5 21,7	0 16 37,6 E	2 15 44,8	9 2,9
Mrs. Thornhill's Obelisk -	50 56 17,5	0 10 28,6 E	2 21 53,8	9 27,6
Odcomb Spire - -	50 56 12,6	0 9 12,1 W	2 41 34,4	10 46,3
Milborne Port - -	50 57 58,0	0 5 13,1 E	2 27 9,3	9 48,6
Puncknoll Flagstaff -	50 41 17,3	0 6 36,4 W	2 38 58,8	10 35,9
Lambert's Castle - -	50 46 17,7	0 17 23,1 W	2 49 45,5	11 19
Lyme Cobb - -	50 43 10,0	0 23 7, W	2 55 29,4	11 41,9
Golden Cape - -	50 43 32,5	0 17 37,2 W	2 49 59,6	11 20
Glastonbury Tor -	51 8 47,7	0 8 56,4 W	2 41 18,8	10 45,2
Bridport Beacon - -	50 41 13,2	0 18 37,6 W	2 50 59,9	11 24
Ld. Rolle's Barn, near Sidmouth	50 45 35,6	0 26 17,2 W	2 58 39,6	11 54,6
Naval Flagstaff, Whitlands	50 42 47,7	0 30 0,4 W	3 2 22,8	12 9,5
Catherstone Lodge - -	51 0 23,0	0 36 36,6 W	3 8 59,0	12 35,9
Lord Lisburne's Obelisk -	50 37 1,3	0 58 5,6 W	3 30 28,1	14 1,9
Sir J. de la Pole's Flagstaff -	50 42 31,9	0 22 21,4 W	2 54 43,8	11 38,9
Honiton Steeple - -	50 47 35,5	0 37 55,7 W	3 10 18,1	12 41,2
St. Mary Ottery Steeple -	50 43 12,9	0 46 26,8 W	3 18 49,2	13 15,3
Sir Robert Palk's Tower -	50 39 52,5	1 2 24,6 W	3 34 47,	14 19,1

Meridian of Butterton Hill.

Names of Objects.	Latitude.	Longitude from Butterton Hill.	Longitude west of Greenwich.	
			In degrees.	In time.
	° ′ ″	° ′ ″	° ′ ″	m. s.
North Bovey Steeple (D.) -	50 36 18,7	0 11 9,3 E	3 41 38,2	14 46,5
Eastern Karn - -	50 38 48,4	0 10 36,3 E	3 42 11,2	14 48,7
Western Karn - -	50 39 27.9	0 10 30,1 E	3 42 17.4	14 49,1
West Down Beacon -	50 37 20.5	0 32 30,0 E	3 20 17,5	13 21,1
Woodley's Summer House	50 33 4.5	0 7 34,5 E	3 45 13	15 0,9
Flagstaff, Berry Head, Torbay	50 24 0,7	0 24 33,1 E	3 28 14,4	13 52,9
Brixen Steeple - -	50 23 12	0 22 24,8 E	3 30 22,7	14 1,5
Ipplepen Steeple -	50 27 34,2	0 17 33,8 E	3 35 13.7	14 20,9
Three Barrow Tor - -	50 29 13,5	0 2 13,5 E	3 50 34	15 22,3
Brent Beacon, near Ashburton	50 26 28,6	0 3 58,1 E	3 48 49.4	15 15,3
Chudleigh Steeple -	50 36 14,1	0 17 25,9 E	3 35 21,6	14 21,4
Froward Flagstaff -	50 21 1,4	0 21 36,3 E	3 31 11,2	14 4.7
Flagstaff, Start Point -	50 13 25,9	0 14 26,7 E	3 38 20,8	14 33,4
Marlborough Steeple -	50 14 40,7	0 4 42,5 E	3 48 5,0	15 12,3
Flagstaff, Bolt Head - -	50 13 14,1	0 4 47,2 E	3 48 0,3	15 12
Mewstone, highest point -	50 18 29,7	0 12 45.1 W	4 5 32,6	16 22,1
Cupola of Plymouth Hospital	50 22 10,1	0 17 8.5 W	4 9 56,1	16 39.7
St. John's Steeple (D.) -	50 22 11,8	0 21 31,4 W	4 14 18,9	16 57,2
Saltash Steeple - -	50 24 39,8	0 18 54.3 W	4 11 41,8	16 42,8
Penlee Beacon - -	50 19 24	0 17 52,6 W	4 10 40,1	16 42,7
Plymstock Steeple - -	50 22 24,2	0 12 36,8 W	4 5 24,3	16 21,6
Statten Barn - -	50 20 37.4	0 13 38,6 W	4 6 26,1	16 25,7
Mount Batten - -	50 21 24,3	0 15 1,6 W	4 7 49,1	16 31,2
Flagstaff, Plymouth Garrison	50 21 21,8	0 14 36,5 W	4 7 24,0	16 29,6
New Church, Plymouth -	50 22 20,4	0 14 29,0 W	4 7 16,5	16 29,1
Old Church, Plymouth -	50 22 13,6	0 14 44,1 W	4 7 31,6	16 30,1
Eddystone Light House -	50 10 54.5	0 22 15,4 W	4 15 2,9	17 0,3
West Chimney, Governor's House, Plymouth Dock -	50 22 2,9	0 16 31,6 W	4 9 19,1	16 37,2
Flagstaff, Mount Wise -	50 22 0,7	0 16 43,7 W	4 9 31,2	16 38,1
Chapel, Plymouth Dock -	50 22 19	0 17 10,8 W	4 9 58,3	16 39,9
Obelisk, Crimhill Passage	50 21 37.7	0 17 5,8 W	4 9 53.3	16 39.5
Mount Edgecumbe House	50 21 17.9	0 16 51,8 W	4 9 39.3	16 38,6
Flagstaff, Maker Tower	50 20 51,8	0 17 28,5 W	4 10 16,0	16 41,1
Naval Flagst. near Maker Tow.	50 20 51,9	0 17 28,6 W	4 10 16,1	16 41,1
Stonehouse Steeple - -	50 20 47.4	0 13 35.7 W	4 6 23,2	16 25,5
Puslinch Obelisk - -	50 20 17,5	0 7 2,6 W	3 59 50.1	15 59.5
Rame Head - -	50 18 51,7	0 19 41,5 W	4 12 29,0	16 49,9
Great Haldon - -	50 39 27	0 18 34,2 W	3 34 13.3	14 16,9
Hemmerdon Ball - -	50 21 21,2	0 7 6,5 W	3 59 53,6	15 59,5
Brent Tor - -	50 36 13,4	0 16 33.9 W	4 9 21,4	16 37,4
Flagstaff, Blockhouse, Plymouth	50 22 56,4	0 16 24,4 W	4 9 11,8	16 36,8

Names of Objects.	Latitude.	Longitude from Butterton Hill.	Longitude west of Greenwich. In degrees.	In time.
	° ′ ″	° ′ ″	° ′ ″	m. s.
Rame Steeple - -	50 19 18,7	0 37 59,8 W	4 30 47,3	18 3,1
Flagstaff, Statten Battery	50 20 31,8	0 13 54,1 W	4 6 41,6	16 26,8
Windmill, Plymouth Dock	50 22 11,6	0 16 54,2 W	4 9 41,7	16 38,8
St. Stephen's Steeple -	50 24 15,1	0 20 3,0 W	4 12 50,5	16 51,3
St. Ive Steeple - -	50 28 49	0 29 20,2 W	4 22 7,7	17 28,5
Linkinghorn Steeple -	50 32 17,3	0 28 39,2 W	4 21 26,7	17 25,8
St. Dominic Steeple (D.) -	50 32 17,8	0 23 1,2 W	4 15 48,7	17 3,2
South Petherwin Steeple -	50 36 30,4	0 29 40,4 W	4 22 27,5	17 29,8
South Hill Steeple - -	50 31 48,3	0 27 46,9 W	4 20 34,4	17 22,3
St. Cleer Steeple - -	50 29 15	0 34 33,1 W	4 27 20,6	17 49,4
Callington Steeple -	50 30 14,9	0 25 14,4 W	4 18 1,9	17 12,1
Cheese Rings - -	50 31 50,5	0 34 14,9 W	4 27 2,4	17 48,1
Liskeard Steeple - -	50 27 14,4	0 33 55,5 W	4 26 43,0	17 46,8
Landrake Steeple -	50 25 20,7	0 23 43,3 W	4 16 30,8	17 6
Duloe Steeple - -	50 23 48,0	0 35 21,9 W	4 28 9,4	17 52,6
Menheniot Steeple -	50 27 14,5	0 31 18,3 W	4 24 5,8	17 36,4
Polparrow Flagstaff -	50 25 5,5	0 35 37,4 W	4 28 24,9	17 53,6
Lord Camelford's Obelisk	50 25 11,1	0 42 4,2 W	4 34 51,7	18 19,4
Boconnock Steeple -	50 25 15,3	0 40 43,7 W	4 33 31,2	18 14,1
Roach Rock - -	50 23 53,4	0 55 41,8 W	4 48 29,4	19 13,9
Roach Steeple - -	50 23 58,7	0 55 59,1 W	4 48 46,6	19 15,1

Meridian of St. Agnes.

Names of Objects.	Latitude.	Longitude from St. Agnes Beacon.	Longitude west of Greenwich. In degrees.	In time.
	° ′ ″	° ′ ″	° ′ ″	m. s.
Lanlivery Steeple -	50 24 1,9	0 30 44,0 E	4 41 11,7	18 44,8
Helmen Tor - -	50 25 9,9	0 29 11,9 E	4 42 43,8	18 50,9
Mr. Tremaine's Summer House	50 16 37,8	0 24 41,6 E	4 47 14,1	19 8,9
Gorran Steeple - -	50 14 50,8	0 24 30,4 E	4 47 25,3	19 9,6
Flagstaff, Deadman -	50 13 15,8	0 24 47,7 E	4 47 8,0	19 8,5
Gwineas Rocks - -	50 14 46,3	0 27 14,1 E	4 44 41,6	18 58,8
Hendellion Steeple -	50 34 25,6	0 23 8,5 E	4 48 47,2	19 15,1
Stone, St. Braeg's Down -	50 28 47,6	0 21 1,7 E	4 50 54,0	19 23,6
St. Dennis Steeple -	50 23 22,1	0 19 54,1 E	4 52 1,6	19 28,1
St. Michael Carhayes Steeple	50 15 14,0	0 21 40,2 E	4 50 15,5	19 21
St. Kivern Steeple -	50 3 5,6	0 7 47,5 E	5 4 8,2	20 16,5
Flagstaff, Blackbead -	50 1 12,1	0 7 56,4 E	5 3 59,3	20 15,9
Windmill, near Fowey -	50 20 7,2	0 34 24,2 E	4 37 31,5	18 30,1
Menabilly House -	50 20 9,9	0 31 37,8 E	4 40 17,9	18 4,11
Old Tower at Polruan -	50 19 40,2	0 34 47,7 E	4 37 8,0	18 28,5
Flagstaff, St. Antbony's Head	50 8 34,2	0 12 24,7 E	4 59 31,0	19 58,1
St. Veep's Steeple -	50 21 57,5	0 35 54,7 E	4 36 1,0	18 24,1
St. Columb Minor Steeple	50 25 20,1	0 10 26,4 E	5 1 29,3	20 5,9
Peranzabulo - -	50 21 59,4	0 4 57,6 E	5 6 58,2	20 27,9

Names of Objects.	Latitude.	Longitude from St. Agnes Beacon.	Longitude west of Greenwich.	
			In degrees.	In time.
	° ′ ″	° ′ ″	° ′ ″	m. s.
St. Eval Steeple -	50 29 3,5	0 12 54,9 E	4 59 0,8	19 56
Cubert Steeple - -	50 22 43,0	0 6 5,6 E	5 5 50,1	20 23,3
Flagstaff, Pendennis Castle	50 8 48,7	0 10 12,1 E	5 1 43,6	20 6,9
Windmill, St. Mawes -	50 10 46,3	0 12 16,3 E	4 59 39,4	19 58,6
Karnbre Castle - -	50 13 23,6	0 1 39,3 W	5 13 35,0	20 54,3
Illugan Steeple -	50 15 4,4	0 3 1,9 W	5 14 57,6	20 59,8
St. Paul's Steeple -	50 1 24,3	0 9 47,0 W	5 21 42,7	21 26,8
Lord Dunstanville's House	50 14 39,4	0 5 2,5 W	5 16 58,2	21 7,8
Lansallos Steeple -	50 20 15,3	0 38 16,2 E	4 33 39,5	18 14,6
Gerrans Steeple -	50 10 44,8	0 14 7,7 E	4 57 48,0	19 51,2
Gwinear Steeple - -	50 10 34,	0 10 6,0 W	5 22 1,7	21 28,1
Cow and Calf - -	50 32 44,8	0 9 33,7 E	5 2 22,0	20 9,5
Camborn Steeple -	50 12 51,0	0 5 4,7 W	5 17 0,4	21 8
St. Erme Steeple -	50 18 36,3	0 11 25,7 E	5 0 30,0	20 2
St. Allen Steeple - -	50 18 56,8	0 9 23,6 E	5 2 32,1	20 10,1
Ludguan Steeple -	50 8 44,1	0 16 30,7 W	5 28 26,4	21 53,8
Windmill, Lizard -	49 59 35,1	0 0 8,7 E	5 12 4,4	20 48,3
Grade Steeple - -	49 59 8,8	0 1 27,1 E	5 10 28,6	20 41,9
Ruan Major Steeple -	50 0 27,2	0 0 22,6 E	5 11 29,1	20 45,9
St. Hilary Steeple -	50 7 38,7	0 12 29,7 W	5 24 25,4	21 37,7
Mr. Rogers's Tower -	50 10 42,4	0 4 41,7 W	5 16 37,4	21 6,5
Madern Steeple - -	50 7 56,6	0 20 47,5 W	5 32 43,2	22 10,9
Park Lougb Flagstaff	50 0 9,9	0 2 43,8 W	5 14 39,5	20 58,6
Lizard Flagstaff -	49 57 55,8	0 0 38,1 E	5 11 17,7	20 45,2
St. Buryan Steeple -	50 4 32,8	0 24 14,8 W	5 36 10,5	22 24,7
Karnbury Chapel -	50 6 23,5	0 24 19,8 W	5 36 15,5	22 25
St. Leven's Point, Flagstaff	50 3 53,8	0 29 8,5 W	5 41 4,2	22 44,3
Sennen Steeple - -	50 4 18,0	0 28 36,6 W	5 40 29,9	22 41,9
Stone, LAND'S END -	50 4 6,6	0 29 35,8 W	5 41 31,5	22 46,1

Notwithstanding almost the whole of the above latitudes and longitudes belong to objects near the sea coast, yet I have distinguised those which are actually upon it, from those more remotely situated, by *Italics.*

ART. XXIX. *Bearings of the Stations in the Series of 1797 and 1798, from the Parallels to the Meridians of Black Down, Butterton Hill, and St. Agnes Beacon; and likewise their Distances from those Meridians*

Meridian of Black Down.

Names of the Stations.		Bearings.	Distances from merid.	Distances from perp.
		° ′ ″	Feet.	Feet
Pilsden -	Moor Lynch -	2 33 59 NW	71070	162067
Ash Beacon -		59 52 59 NW		
Mintern -	Ash Beacon -	5 17 18 NW	5544	117624
Moor Lynch -		59 53 1 SE		
Bull Barrow -	Long Knoll -	1 2 34 NE	55557	164653
Ash Beacon -		46 45 33 NE		
Pilsden -	Dundon -	12 40 33 NE	42964	145377
Moor Lynch -		59 17 35 SE		
Moor Lynch -	Mendip -	66 3 36 NE	1021	194072
Ash Beacon -		3 23 8 NW		
Long Knoll -	Beacon Hill -	82 28 4 NE	189665	182386
Wingreen -		50 16 22 NW		
Long Knoll -	Westbury -	39 44 34 NE	92715	209344
Mendip -		80 32 31 NE		
Westbury -	Farley Down	35 44 37 NW	57752	257920
Dundry -		88 51 23 SE		
Mendip -	Dundry -	18 59 1 NW	21488	259503
Farley Down -		88 51 22 NW		
Mendip -	Lansdown -	22 4 57 NE	32440	271514
Dundry -		77 26 41 NE		

Meridian of Butterton Hill.

Carraton Hill -	St. Stephen's -	15 15 47 NE	112457	87635
Kit Hill -		21 46 9 NW		
Carraton Hill -	Black Down -	64 12 55 NE	51797	72555
St. Stephen's -		76 2 26 SE		

Meridian of St. Agnes Beacon.

St. Agnes Beacon	Trevose Head	25 54 12 NE	42858	88250
Hensbarrow -		39 49 34 NW		
Trevose Head -	Cadon Barrow	63 18 48 NE	119364	126702
Bodmin Down -		2 11 52 NW		
Bodmin Down -	Brown Willy -	28 46 20 NE	142745	104145
Cadon Barrow -		46 1 42 SE		

ART. XXX. *Bearings of the Stations in the Series of 1799, from the Parallels to the Meridians of Dunnose and Greenwich; and likewise their Distances from those Meridians.*

Meridian of Dunnose.

Names of the Stations.		Bearings.	Distances from merid.	Distances from perp.
		° ′ ″	Feet.	Feet.
Highclere -	Bagshot Heath -	81 40 58 NE	108275	274173
	Nuffield - -	35 30 40 NE	36747	351480
	White Horse Hill -	27 47 37 NW	83796	349533
White Horse Hill	Stow on the Wold	14 29 27 NW	114915	469942
	Brill - -	50 16 17 NE	28955	443235
	Shotover Hill -	53 30 7 NE	3063	413801
	Scutchamfly -	84 25 51 SE	32776	344558
	Whiteham Hill -	36 30 13 NE	31054	420801
Stow on the Wold	Broadway - -	33 3 55 NW	143396	513693
	Epwell - -	39 34 55 NE	64617	530781
Shotover Hill -	Cumner Hill -	76 58 3 SW	25416	407209
Epwell - -	Corley Hill -	6 39 56 NW	81312	673637
	Arbury Hill -	48 5 23 NE	2776	586288
Brill - -	Crouch Hill -	39 20 49 NW	36102	522584
	Quainton - -	61 40 13 NE	64963	462648

Meridian of Greenwich.

Nuffield -	Wendover -	44 48 19 NE	174338	100986
Brill - -		65 49 3 SE		
Brill - -	Bow Brickhill	56 46 9 NE	151413	190493
Arbury Hill -		54 50 52 SE		
Brill - -	Kinsworth -	85 8 30 NE	120910	141562
Bow Brickhill -		31 55 51 SE		
Bow Brickhill -	Lillyhoe -	74 6 27 SE	84215	171367
Kinsworth -		50 54 40 NE		
Bow Brickhill -	Lidlington -	67 24 37 NE	121834	202802
Lillyhoe -		50 6 55 NW		
Bow Brickhill -	Trusler Hill -	89 1 15 SE	131278	190152
Lillyhoe -		68 14 71 NW		

ART. XXXI. *Latitudes and Longitudes of the Stations in the Series of 1797 and 1798, referred to the Meridians of Black Down, Butterton Hill, and St. Agnes Beacon.*

Meridian of Black Down.

Names of the Stations.	Latitude.	Longitude from Black Down.	Longitude west of Greenwich.	
			In degrees.	In time.
	° ′ ″	° ′ ″	° ′ ″	m. s.
Moor Lynch	51 7 50,2	0 18 30,6 W	2 50 53	11 23,5
Ash Beacon	51 0 33,5	0 1 26,4 E	2 30 56	10 3,7
Long Knoll	51 8 16,2	0 14 28,3 E	2 17 54,1	9 11,6
Dundon	51 5 6,5	0 11 10,7 W	2 43 33,1	10 54,2
Mendip	51 13 7,2	0 0 15,9 E	2 32 6,5	10 8,4
Beacon Hill	51 11 1,6	0 49 20,6 E	1 43 1,8	6 52,1
Westbury	51 15 35,3	0 24 13 E	2 8 9,4	8 32,6
Farley Down	51 23 35,7	0 15 7,6 E	2 17 14,8	9 8,9
Dundry	51 23 52,2	0 5 37,7 W	2 38 0,1	10 32,0
Lansdown	51 27 50,4	0 8 30,6 E	2 23 51,8	9 35,4

Meridian of Butterton Hill.

Names of the Stations.	Latitude.	Longitude from Butterton Hill.	Longitude west of Greenwich.	
			In degrees.	In time.
	° ′ ″	° ′ ″	° ′ ″	m. s.
St. Stephen's	50 39 6,7	0 28 59,6 W	4 21 47,1	17 27,1
Black Down	50 36 40,9	0 13 20,5 W	4 6 8,0	16 24,5

Meridian of St. Agnes Beacon.

Names of the Stations.	Latitude.	Longitude from St. Agnes Beacon.	Longitude west of Greenwich.	
			In degrees.	In time.
	° ′ ″	° ′ ″	° ′ ″	m. s.
Trevose Head	50 32 56,5	0 11 1,5 E	5 0 54,2	20 3,6
Cadon Barrow	50 39 12,1	0 30 46,5 E	4 41 9,2	18 44,6
Brown Willy	50 35 27,9	0 36 45,3 E	4 35 10,4	18 20,6

ART. XXXII. *Latitudes and Longitudes of the Stations in the Series of* 1799, *referred to the Meridians of Dunnose and Greenwich.*

Meridian of Dunnose.

Names of the Stations.	Latitude.	Longitude from Dunnose.	Longitude west of Greenwich.	
			In degrees.	In time.
	° ′ ″	° ′ ″	° ′ ″	m. s.
Nuffield - - -	51 34 52,2	0 9 39,9 E	1 1 56,1	4 7,7
White Horse Hill -	51 34 31,6	0 22 1,7 W	1 33 37,7	6 14,5
Stow on the Wold - -	51 54 16,3	0 30 26,7 W	1 42 2,4	6 48,1
Broadway - -	52 1 25,6	0 38 5,3 W	1 49 41,3	7 18,7
Brill - - -	51 49 56,6	0 7 39,4 E	1 3 56,6	4 15,7
Scutchamfly - -	51 33 44,1	0 8 37 W	1 20 13,0	5 20,8
Shotover Hill - -	51 45 6,7	0 0 48,5 E	1 10 47,5	4 43,1
Whiteham Hill - -	51 46 15,4	0 8 12,1 W	1 19 48,1	5 19,2
Cumner Hill - -	51 44 1,5	0 6 42,4 W	1 18 18,4	5 13,2
Epwell - - -	52 4 19,8	0 17 10,8 W	1 28 46,8	5 55,1
Corley Hill - -	51 50 28,3	0 9 39,9 W	1 21 15,9	5 25,0
Arbury Hill - -	52 13 26,6	0 0 44,4 W	1 12 20,4	4 49,3
Crouch Hill - -	52 2 58,7	0 9 35,6 W	1 21 11,6	5 24,7
Quainton - -	51 53 7,2	0 17 12,1 E	0 54 23,9	3 37,6

Meridian of Greenwich.

Names of the Stations.	Latitude.	Longitude west of Greenwich.	
		In degrees.	In time.
	° ′ ″	° ′ ″	m. s.
Wendover - -	51 45 6,4	0 46 1,4	3 4,1
Bow Brickhill - -	51 59 50,5	0 40 1,2	2 44,1
Kinsworth - -	51 51 50,8	0 31 59,9	2 7,9
Lillyhoe - - -	51 56 46,5	0 22 19,5	1 29,3
Lidlington - -	52 1 54,0	0 32 21,7	2 9,4
Trusler Hill - -	51 59 48,0	0 34 50,5	2 19,3

ART. XXXIII. *Bearings of intersected Objects, from the Stations in the Series of 1797 and 1798, from the Parallels to the Meridians of Black Down, Butterton Hill, and St. Agnes Beacon; and likewise their Distances from those Meridians.*

Meridian of Black Down.

Bearings from the Parallels to the Meridian.					Distances from merid.	Distances from perp.
	°	′	″		Feet.	Feet.
At Moor Lynch.						
Walton Windmill	75	12	31	S E	51340	156858
Westonzoyland Steeple	63	42	36	S W	46928	154235
Middlezoy Steeple	31	48	21	S W	79339	148733
Chedzoy Steeple	85	18	45	N W	90459	163658
Higham Windmill	29	57	17	S E	58858	140880
Higham Steeple	22	51	39	S E	62691	142196
Bridgewater Spire	88	39	25	S W	104717	161280
Somerton Steeple	47	4	54	S E	41197	134292
Burton Pynsent Obelisk	10	35	4	S W	78428	122688
At Dundry.						
Puckle Steeple	55	19	25	N E	26010	292363
Westleigh Steeple	46	49	23	N E	23610	301818
Bristol Cathedral	26	7	30	N E	11836	279184
Redcliff Steeple	33	8	32	N E	9407	278007
Long Aston	0	51	38	N W	21696	273385
Clifden Windmill	9	52	50	N E	19281	272172
Blaze Castle	1	49	16	N E	20268	297874
Penpole Park Gazebo	11	43	37	N W	28680	294155
Duke of Beaufort's House, Stoke	32	31	51	N E	651	294212
Durham Steeple	63	28	33	N E	38049	289219
Knowle Steeple	13	41	30	N E	8112	314410
Mangotsfield Steeple	47	44	31	N E	13923	291677
Winterbown Steeple	31	14	10	N E	7056	306569
Harfield Steeple	20	11	9	N E	93478	292526
Leigh on Mendip	33	59	55	S E	21483	195794
Dundry Steeple	71	23	20	S W	22831	259052
At Long Knoll.						
Doulting Spire	68	59	51	N W	9544	182322
Frome Steeple	5	20	25	N W	52415	198272
At Farley Down.						
Devizes Steeple	79	51	30	S E	129342	245113
Cold Aston Steeple	33	43	21	N W	44362	277983

Meridian of Butterton Hill.

Bearings from the Parallels to the Meridian.		Distances from merid.	Distances from perp.
At Furland.	° ′ ″	Feet.	Feet.
Hope's Nose	23 7 55 NE	93759	18745
At St. Stephen's.			
Werrington Steeple	29 37 23 NE	109839	92242
Boyton Steeple	0 55 35 NW	112767	106733
St. Stephen's Steeple	45 55 4 SE	110738	85968
North Petherwin Steeple	49 15 49 NW	125044	98473
At Carraton Hill.			
Stokeclimsland Steeple	65 56 2 NE	96381	49922
Launceston Steeple	21 26 54 NE	108267	82689
Launceston Chapel	21 14 13 NE	108513	82561

Meridian of St. Agnes Beacon.

At Bodmin.			
St. Minvern Steeple	58 18 36 NW	79549	91845
St. Minvern Windmill	61 51 46 NW	90966	82260
At Trevose Head.			
St. Isey Steeple	61 2 12 SE	68456	74082
St. Merian Steeple	57 59 32 SE	52096	82476

ART. XXXIV. *Bearings of intersected Objects, from the Stations in the Series of* 1799, *from the Parallels to the Meridians of Dunnose and Greenwich; and likewise their Distances from those Meridians.*

Meridian of Dunnose.

At Epwell.			
Warwick Steeple	16 25 48 NW	87242	607508
St. Martin's, Coventry	2 3 42 NW	69028	653327
Soleyhul Spire	31 8 35 NW	128826	654971
At Arbury Hill.			
Dunchurch Windmill	23 55 48 NW	20724	626734
Breadon Hill, Summer House	7 37 31 NW	26706	765038

Bearings from the Parallels to the Meridian.					Distances from merid.	Distances from perp.
	°	′	″		Feet.	Feet.
Markfield Windmill	5	20	7	N W	18608	755819
Newnham Windmill	59	36	2	N E	2261	589244
At Corley Hill.						
Gazebo, Breadon Hill	35	45	58	S W	188086	525408
At Crouch Hill.						
Deddington Steeple	18	6	0	S E	28646	499771
Bloxham Spire	16	35	11	S W	39519	511110
Aynoe Steeple	49	26	2	S E	11944	501902
Adderbury Spire	37	26	59	S E	26213	509671
Farthingo Steeple	36	26	49	S E	6431	502904
At Arbury Hill.						
Round House, Edge Hills	56	15	5	S W	57501	549724
Windmill, near the Round House	55	39	29	S W	58398	548286
At Brill.						
Wingrove Steeple	81	17	5	N E	103826	454713
Hardwick Steeple	78	6	1	N E	83299	454687
Luggersal Steeple	44	56	1	N E	35106	449401
Granborough Steeple	53	9	30	N E	70782	474574
Bicester Steeple	43	27	16	N W	6854	466560
Marq. Buckingham's House, Wooton	79	17	25	N E	43490	445984
Islip Steeple	84	26	3	S W	8944	439540
Woodstock Steeple	85	25	45	N W	35563	448393
Kidlington Spire	88	29	39	S W	18401	441989
Witchwood Beacon	89	11	34	S W	76971	444726
At Whitehorse Hill.						
Abingdon Spire	62	38	18	N E	19054	383037
Wallingford Steeple	84	54	39	N E	17497	358560
Great Coxwell Windmill	25	45	11	NW	96959	376819
Drayton Steeple	67	28	0	N E	24691	374055
Highworth Steeple	57	49	58	N W	116343	370003
Witney Spire	14	14	57	N E	64787	424386
Bampton Steeple	4	36	29	N E	79056	408334
Radley Steeple	61	25	12	N E	12123	388578
Buckland Steeple	20	8	12	N E	69616	388204
At Stow.						
Stow on the Wold Steeple	20	55	25	NW	118442	479166
At Broadway.						
Sarsden Chapel	52	29	8	S E	86195	469777
Bourton Chapel	54	36	35	S E	125636	501076
Walford Spire	82	38	42	S E	98704	507924

Meridian of Greenwich.

Bearings from the Parallels to the Meridian.					Distances from merid.	Distances from perp.
	°	′	″		Feet.	Feet.
At Wendover.						
Pitchcot Windmill - -	19	11	59	N W	191077	149055
Ivinghoe Spire - -	45	44	37	N E	143127	131397
Quainton Steeple - -	34	47	15	N W	205750	146203
Leighton Buzzard Spire -	21	41	12	N E	150616	160663
At Quainton.						
Southern Obelisk, Stow Park -	22	1	36	N W	227554	204673
Northern Obelisk, ditto -	21	50	48	N W	228505	207532
At Kinsworth.						
Aylesbury Spire - -	77	56	58	S W	190234	126763
Maulden Steeple - -	16	30	28	N E	102962	202124
Harlington Steeple - -	16	12	37	N E	110395	177730
Millbrook Steeple - -	3	1	41	N E	117732	201645
Stretley Steeple - -	35	23	47	N E	99961	171044
Sauldon Windmill - -	60	20	46	N W	178643	174431
At Bow Brickhill.						
Hanslope Spire - -	38	58	48	N W	185668	232843
North Crawley Steeple -	9	41	15	N E	145529	224961
Pavenham Spire - -	22	15	49	N E	122215	261812
St. Paul's Spire, Bedford -	43	9	11	N E	104408	240631
Sharnbrook Spire - -	19	21	54	N E	123533	269816
Woburn Market-House -	73	52	37	S E	139255	186978
Ridgemont Station - -	72	28	11	N E	130927	196964
Wootton Spire - -	41	33	7	N E	120265	225685
Cranfield Spire - -	30	44	22	N E	136284	215935
Husborne Crawley Steeple -	65	44	51	N E	136827	197964
Woburn Steeple - -	75	33	58	S E	139373	187394
Souldrope Spire - -	16	32	49	N E	124861	279861
Windmill near Tharfield -	86	6	12	N E	12577	199950
Tottenhoe Station - -	27	42	7	S E	130412	150494
Chalgrave Steeple - -	53	51	5	S E	116215	164780
Keysoe Spire - -	31	17	59	N E	95682	282155
Moulshoe Steeple - -	2	19	30	N W	152432	215608
Renhold Spire - -	44	56	16	N E	91651	250385
Lidlington Windmill -	62	30	6	N E	125855	203797
At Lillyhoe.						
Knotting-Green Elm Tree -	16	17	56	N W	117482	285139
Ravensden Steeple - -	7	25	2	N W	95142	255804
Bow Brickhill Steeple -	73	20	18	N W	151490	191501

Bearings from the Parallels to the Meridian.		Distances from merid.	Distances from perp.
	° ′ ″	Feet.	Feet.
Colmworth Spire	0 12 52 N W	84580	268984
Sundon Windmill	75 0 6 S W	109032	164718
Silsoe Steeple	26 9 25 N W	95501	194345
Flitton Steeple	38 20 32 N W	102831	194903
Shillington Steeple	7 49 43 N E	81919	188066
Westoning Steeple	64 42 19 N W	113366	185143
Wrest-Garden Obelisk	26 26 8 N W	94797	192652
Flitwick Steeple	57 11 27 N W	114694	191016
Ampthill Steeple	39 6 3 N W	109957	203041
St. Neot's Steeple	13 32 16 N E	59630	273475
Pollux Hill Steeple	47 5 30 N W	102236	188118

Art. xxxv. *Latitudes and Longitudes of such Places, in the Series of* 1797 *and* 1798, *as have been referred to the Meridians of Black Down, Butterton Hill, and St. Agnes Beacon.*

Meridian of Black Down.

Names of the Objects.	Latitude.	Longitude from Black Down.	Longitude west of Greenwich. In degrees.	Longitude west of Greenwich. In time.
	° ′ ″	° ′ ″	° ′ ″	m. s.
Walton Windmill	51 6 59.5	0 13 22,1 W	2 45 44,5	11 2,9
Westonzoyland Steeple	51 6 33,8	0 12 12,9 W	2 44 35,3	10 58,3
Middlezoy Steeple	51 5 38,3	0 20 38,8 W	2 53 1,2	11 32,1
Chedzoy Steeple	51 8 5,1	0 23 33,7 W	2 55 56,1	11 43,7
Higham Windmill	51 4 21,8	0 15 18,6 W	2 47 41,0	11 10,7
Higham Steeple	51 4 34,6	0 16 18,5 W	2 48 40,9	11 14,7
Bridgewater Spire	51 7 40,7	0 27 16,3 W	2 59 38,7	11 58,6
Somerton Steeple	51 3 17,3	0 10 42,7 W	2 43 5,1	10 52,3
Burton Pynsent Ohelisk	51 1 21,6	0 20 22,7 W	2 52 45,1	11 31
Westleigh Steeple	51 30 49.4	0 6 12,0 E	2 26 10,4	9 44,7
Bristol Cathedral	51 27 6,3	0 3 6,2 W	2 35 28,6	10 21,9
Redcliff Steeple	51 26 54,8	0 2 28,0 W	2 34 50,4	10 19,3
Long Aston	51 26 9,1	0 5 41,3 W	2 38 3,7	10 32,2
Clifden Windmill	51 25 57,2	0 5 3,3 W	2 37 25,7	10 29,7
Blaze Castle	51 30 10,4	0 5 19,3 W	2 37 41,7	10 30,8
Penpole Gazebo	51 29 33,7	0 7 31,7 W	2 39 54,1	10 39,6
Duke of Beaufort's House, Stoke	51 29 34,5	0 0 10,2 E	2 32 12,2	10 8,8
Durham Steeple	51 28 44,8	0 9 59,0 E	2 22 23,4	9 29,5
Knowle Steeple	51 32 53,7	0 2 7,9 W	2 34 30,3	10 18
Mangotsfield Steeple	51 29 9.5	0 3 39,2 E	2 28 43,2	9 54,8
Winterbown Steeple	51 31 36,4	0 1 51,2 E	2 30 31,2	10 2,1
Harfield Steeple	51 29 15,3	0 24 32,2 W	2 56 54,6	11 47,6
Leigh Steeple on Mendip	51 13 24,	0 5 36,3 E	2 26 46,1	9 47,1
Dundry Steeple	51 23 47,7	0 5 58,8 W	2 38 21,2	10 33,4

Names of the Objects.	Latitude.	Longitude from Black Down.	Longitude west of Greenwich.	
			In degrees.	In time.
	° ′ ″	° ′ ″	° ′ ″	m. s.
Doulting Spire - -	51 11 11,4	0 2 29,3 E	2 29 53,1	9 59,5
Devizes Steeple -	51 21 25,5	0 33 51,2 E	2 58 31,2	11 54,1
Frome Steeple - -	51 13 47,9	0 13 40,8 E	2 18 41,6	9 14,7
Cold Aston - -	51 26 53,9	0 11 38,0 E	2 20 44,4	9 24,9
Puckle Steeple -	51 29 16,2	0 6 49,6 E	2 25 32,8	9 42,2

Meridian of Butterton Hill.

Names of Objects.	Latitude.	Longitude from Butterton Hill.	Longitude west of Greenwich.	
			In degrees.	In time.
	° ′ ″	° ′ ″	° ′ ″	m. s.
Hope's Nose, Torbay -	50 27 48,5	0 26 4,4 E	3 26 43,1	13 46,9
Werrington Steeple	50 39 52,2	0 28 19,4 W	4 21 6,9	17 24,4
Boyton Steeple - -	50 42 14,9	0 29 6,1 W	4 21 53,6	17 27,5
North Petherwin -	50 40 52,5	0 32 15,3 W	4 25 2,8	17 40,2
St. Stephen's Steeple -	50 38 50,3	0 28 32,6 W	4 21 20,1	17 25,3
Stokeclimsland Steeple -	50 32 55,8	0 24 47,5 W	4 17 35,0	17 10,3
Launceston Steeple -	50 38 18,1	0 27 54,1 W	4 20 41,6	17 22,7
Launceston Castle -	50 38 16,8	0 27 57,9 W	4 20 45,4	17 23

Meridian of St. Agnes Beacon.

Names of Objects.	Latitude.	Longitude from St. Agnes Beacon.	Longitude west of Greenwich.	
			In degrees.	In time.
	° ′ ″	° ′ ″	° ′ ″	m. s.
St. Minvern Steeple -	50 33 30,6	0 20 28,1 E	4 51 27,6	19 25,8
St. Minvern Windmill -	50 31 55,5	0 23 23,5 E	4 48 32,2	19 14,1
St. Isey Steeple -	50 30 36,0	0 17 36,6 E	4 54 20,1	19 37,3
St. Merian Steeple -	50 31 59,3	0 13 23,8 E	4 58 31,9	19 54,1

ART. XXXVI. *Latitudes and Longitudes of such Places, in the Series of* 1799, *as have been referred to the Meridians of Dunnose and Greenwich.*

Meridian of Dunnose.

Names of Objects.	Latitude.	Longitude from Dunnose.	Longitude west of Greenwich.	
			In degrees.	In time.
	° ′ ″	° ′ ″	° ′ ″	m. s.
Warwick Steeple -	52 16 53,0	0 23 18,3 W	1 34 54,3	6 19,6
St. Martin's Spire, Coventry	52 24 25,4	0 18 29,5 W	1 30 5,5	6 0,3
Soleyhull Spire - -	52 2 30,4	0 34 13,8 W	1 45 49,3	9 3,3
Dunchurch Windmill -	52 20 4,6	0 5 32,5 W	1 17 8,5	5 8,6

Names of Objects.	Latitude.	Longitude from Dunnose.	Longitude west of Greenwich. In degrees.	In time.
	° ′ ″	° ′ ″	° ′ ″	m. s.
Gazebo, Bardon Hill *	52 42 47,6	0 7 12,2 W	1 18 48,2	5 15,2
Markfield Windmill	52 41 16,8	0 5 1,0 W	1 16 37,0	5 6,5
Breadon Hill Building †	52 3 16,7	0 49 59,7 W	2 1 35,7	8 6,4
Newnham Windmill	52 13 55,7	0 0 36,2 E	1 10 59,8	4 43,9
Deddington Steeple	51 59 13,9	0 7 36,1 W	1 19 12,1	5 16,8
Bloxham Spire	52 1 5,6	0 10 29,7 W	1 22 5,7	5 28,4
Aynoe Steeple	51 59 35,2	0 3 10,2 W	1 14 46,2	4 59,1
Adderbury Spire	52 0 51,6	0 6 3,7 W	1 17 39,7	5 10,6
Farthingo Steeple	51 59 45,1	0 1 42,4 W	1 13 18,4	4 53,2
Round House, Edge Hills	52 7 25,6	0 15 18,4 W	1 26 54,4	5 47,6
Round House Windmill	52 7 11,4	0 15 32,6 W	1 27 8,6	5 48,6
Wingrove Steeple	51 51 46,8	0 27 28,7 E	0 44 7,3	2 56,5
Hardwick Steeple	51 51 47,8	0 22 2,6 E	0 49 33,4	3 18,2
Luggersal Steeple, Bucks	51 50 57,3	0 9 17,2 E	1 2 18,8	4 9,2
Granborough Steeple	51 55 4,3	0 18 45,2 E	0 52 50,8	3 31,4
Bicester Steeple	51 53 46,8	0 1 48,9 E	1 9 47,1	4 39,1
Abingdon Spire	51 40 3,8	0 5 1,2 W	1 16 37,2	5 6,5
Wallingford Steeple	51 36 2,4	0 4 36,2 E	1 6 59,8	4 27,9
Great Coxwell Windmill	51 38 59,8	0 25 32,4 W	1 37 8,4	6 28,5
Drayton Steeple	51 38 35	0 6 30,1 W	1 18 6,1	5 12,4
Highworth Steeple	51 37 51,4	0 30 38,1 W	1 42 14,1	6 48,9
Witney Spire	51 46 49,9	0 17 6,9 W	1 28 42,9	5 54,8
Bampton Steeple	51 44 11,2	0 20 51,9 W	1 32 27,9	6 9,8
Radley Steeple	51 40 58,3	0 31 57,4 W	1 43 33,4	6 54,2
Buckland Steeple	51 40 53,3	0 18 21,1 W	1 29 57,1	5 59,8
Witchwood Beacon	51 50 9,8	0 20 21,6 W	1 31 57,6	6 7,8
Stow on the Wold	51 55 46,9	0 31 23,6 W	1 42 59,6	6 51,9
Sarsden Chapel	51 54 16,4	0 22 49,9 W	1 34 25,9	6 17,7
Bourton Chapel	51 59 22,5	0 33 20,7 W	1 44 56,7	6 59,8
Walford Spire	52 0 31,6	0 26 12,5 W	1 37 48,5	6 31,2
Islip Steeple	51 49 20,7	0 2 21,9 W	1 13 57,9	4 55,8
Woodstock Steeple	51 50 47,4	0 9 24,5 W	1 21 0	5 24
Kidlington Spire	51 49 44,6	0 4 51,9 W	1 16 27,9	5 5,8

Meridian of Greenwich.

Names of Objects.	Latitude.	Longitude west of Greenwich. In degrees.	In time.
	° ′ ″	° ′ ″	m. s.
Pitchcot Windmill	51 52 58,5	0 50 35,5	3 22,3
Ivinghoe Spire	51 50 9,1	0 37 51,3	2 31,4
Quainton Steeple	51 52 28,7	0 54 28,0	3 37,8
Southern Obelisk, Stow Park	52 2 2,2	1 0 27,1	4 1,8
Northern Obelisk, ditto	50 2 30,2	1 0 42,9	4 2,8

* In page 658, this is, by mistake, called Breadon Hill Summer House.

† In page 659, this building is called Gazebo.

Names of Objects.	Latitude.			Longitude west of Greenwich.				
				In degrees.			In time.	
	°	′	″	°	′	″	m.	s.
Leighton Buzzard Spire	51	54	56,5	0	39	54,4	2	39,6
Aylesbury Spire	51	49	18,9	0	50	18	3	21,2
Hanslope Spire	52	6	45,2	0	49	17,8	3	17,2
North Crawley Spire	52	5	31,1	0	38	38,4	2	34,5
Pavenham Spire	52	11	36,3	0	32	27,0	2	9,8
St. Paul's Spire, Bedford	52	8	8,8	0	27	43,3	1	50,9
Sharnbrook Spire	52	12	55,1	0	32	48,0	2	11,2
Woburn Market-House	51	59	17,4	0	36	58,5	2	27,9
Woburn Steeple	51	59	21,8	0	37	0,3	2	28
Ridgemont Station	52	0	56,4	0	34	45,7	2	19
Wootton Steeple	52	5	39,2	0	31	55,7	2	7,7
Cranfield Spire	52	4	3,1	0	36	11,1	2	24,7
Husborne Crawley Steeple	52	0	57,0	0	36	19,8	2	25,3
Souldrope Spire	52	14	38,6	0	33	9,1	2	12,6
Windmill near Tharfield	52	1	30,9	0	3	20,4	0	13,3
Tottenhoe Station	51	53	18,9	0	34	37,5	2	18,5
Chalgrave Steeple	51	55	40,2	0	30	51,4	2	3,4
Keysoe Spire	52	14	58,5	0	25	24,3	1	41,6
Moulshoe Steeple	52	2	59,0	0	40	39,6	2	42,6
Renhold Spire	52	9	41,5	0	24	20,1	1	37,3
Lidlington Windmill	52	2	4,2	0	33	25,0	2	13,7
Maulden Steeple	52	1	52,2	0	27	20,2	1	49,3
Harlington Steeple	51	57	48,4	0	29	18,6	1	57,2
Millbrook Steeple	52	1	43,6	0	31	15,5	2	5
Stretley Steeple	51	56	42,8	0	26	12,4	1	44,8
Sauldon Windmill	51	57	9,7	0	47	26,9	3	9,8
Knotting-Green Elm Tree	52	15	26,6	0	31	11,5	2	4,7
Ravensden Steeple	52	10	33,9	0	25	15,7	1	41
Bow Brickhill Steeple	52	0	1,1	0	40	13,4	2	40,9
Colmworth Spire	52	12	49,3	0	22	27,0	1	28,5
Sundon Windmill	51	57	52,2	0	28	57,0	1	55,8
Silsoe Steeple	52	0	33,0	0	25	21,4	1	41,4
Flitton Steeple	52	0	42,1	0	27	14,4	1	48,9
Shillington Steeple	51	59	31,7	0	21	45,0	1	27
Westoning Steeple	51	59	2,7	0	30	5,9	2	0,4
Wrest-Garden Obelisk	52	0	16,2	0	25	10,7	1	40,7
Flitwick Steeple	51	59	58,6	0	30	27,1	2	1,8
Ampthill Steeple	52	1	57,8	0	29	11,7	1	56,7
St. Neot's Steeple	52	13	34,7	0	15	49,9	1	3,3
Pollux Hill Steeple	51	59	31,2	0	27	8,7	1	48,6

ART. XXXVII. *Latitudes and Longitudes of some remarkable Places, not contained in the preceding Tables.*

St. Nicholas's or Drake's Island, in Plymouth Sound.

The bearing of Kit Hill, from the meridian of Butterton, is 67° 12′ 12″, and the angle between it and the flagstaff on Drake's Island, 41° 40′ 8″; therefore, the bearing of the latter from the meridian is 71° 7′ 40″; consequently, its distance from the meridian is 60531 feet, and from the perpendicular 20692 feet, which respectively subtend 9′ 53″6, and 3′ 24″,5. These, with the latitude and longitude of Butterton, 50° 24′ 46″,3 and 3° 52′ 47″,5, give 50° 21′ 21″,1 for the latitude, and 4° 8′ 17″,9 for the longitude, of the flagstaff on Drake's Island.

The latitude and longitude of this spot was determined by Mr. BAYLEY, in the year 1792. The observations for the former were as follows:

50° 21′ 20″ ⊙'s LL.
50 21 30,5 ditto.
50 21 31 ditto.
50 21 29 α Aquilæ.
50 21 26,5 α Ophiuchi.
50 21 55 ⊙'s LL. The mean of these is 50° 21′ 28″,5.

The place chosen by Mr. BAYLEY, as I have been lately informed, was a few feet northward of the staff; therefore, 7″,4 may be taken for the true difference between our determinations.

The longitude of Mr. BAYLEY's station, found by the *moon's transit*, was 4° 18′ 52″; but the longitude deduced from the recent operations, is 4° 8′ 17″,9; there is, therefore, a difference of 10′ 34″,1 between the two determinations.

St. Andrew's or the Old Church, at Plymouth.

The angle at Butterton, between the Old Church tower and Kit Hill, is 37° 45′ 5″,2; its bearing, therefore, south-west from the meridian, is 75° 1′ 56″; consequently, its distance from the meridian is 57505 feet, and from the perpendicular 15374 feet. These respectively subtend 9′ 24″, and 2′ 32″,1: hence, its latitude becomes 50° 22′ 13″,6, and longitude 4° 7′ 31″,6 = 16^{m} 30^{s},1 in time, west of Greenwich.

As it is of very great importance that the truths of the conclusions given in this Work should receive support, wherever I can find it, I think it right to mention the result of his Excellency the Count de Bruhl's endeavours to ascertain the longitude of Plymouth, by means of chronometers. The following is a copy of his communication, made in the year 1795.

Journey from Plymouth to London.

Green Timekeeper.

June 8th, 1783.	Mr. Mudge's clock* at Plymouth, fast for mean time	0^{m}	32^{s},15
	Timekeeper faster than Mr. Mudge's clock -	0	25,6
14th.	Timekeeper slower than London clock -	14	29,4
	London clock slow for mean time - -	0	36,5
	Difference of longitude -	16	3,65

Blue Timekeeper.

June 8th,	Mr. Mudge's clock at Plymouth, fast for mean time	0^{m}	32^{s},15
	Timekeeper faster than Mr. Mudge's clock -	0	37,4
14th.	Timekeeper slower than London clock -	14	17,2
	London clock slow for mean time - -	0	36,5
	Difference of longitude -	16	3,25
	Mean difference - -	16	3,55

The longitude of St. Paul's, west of Greenwich, is 23^{s},1 in time; and Mr. Dutton's house in Fleet-street is about 2^{s} west of St. Paul's;* wherefore, its longitude west of Greenwich is 25^{s}: consequently, $16^{m}\ 3^{s},55 + 25^{s} = 16^{m}\ 28^{s},55$, is the difference of longitude between Greenwich and Plymouth, as shewn by the timekeepers.

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* It is, perhaps, right to observe, that Mr. T. Mudge's transit, at Plymouth, was made by the late Mr. Bird, and properly set up between stone pillars. The clock, the entire work of his own hands, was a most excellent one.

Now the meridian of Mr. Mudge's transit-room, at Plymouth, passed only 35 feet to the eastward of the centre of St. Andrew's Tower, his northern meridian mark being on the church itself; therefore, the longitude of the church and transit-room may be considered the same. From the survey, we find it to be $16^{m}\ 30^{s},1$; and, from Count Bruhl's determination, making a just allowance for the difference of longitude between the late Mr. Dutton's house and Greenwich, $16^{m}\ 28^{s},5$.

It is left for the public, and this learned Society in particular, to determine how far the near agreement of these several methods, tends to corroborate the assertion I have advanced, of the dependence which may be placed on the deductions drawn from the observations made at Beachy Head and Dunnose. If there had been only one watch employed on the occasion, the result would not have been so satisfactory as the circumstance of two being used seems to make it. As the occasion calls for the remark, before I dismiss this article, I must observe, that the highest advantages would accrue to geography, were the ideas of the Astronomer Royal carried into execution, (and which I shall endeavour to do at some future period,) respecting the discovery of the difference of longitude between Greenwich and some very remote point on the western side of the island, (St. David's Head for instance,) by means of timekeepers, carried backwards and forwards in the mail coaches. If this excellent scheme were executed, and the watches employed equal to the best now made, it is probable that the true difference of longitude would shortly be determined. The geodetical situation of St. David's Head will, ere long, be ascertained from a prosecution of the survey: a knowledge, therefore, of its true longitude would be attended with eminent advantages.

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* According to Horwood's Map of London, the distance from the centre of St. Paul's to Bolt Court, at the corner of which Mr. Dutton's house is situated, is 31 chains.

Lizard Light-Houses.

The light-houses on this head-land were observed from Pertinney and Karnbonellis. At the latter, Pertinney bears 74° 22′ 41″ south-west, from the parallel to the meridian of St. Agnes; and, as the angle between the western light-house and Pertinney is 78° 40′ 5″, it follows, that the bearing of the light-house from the said parallel is 4° 17′ 24″ south-east. Computing with this angle and the distance from Karnbonellis to the light-house, we get 3344 feet, and 126499 feet, for the distances of that object from the meridian and perpendicular of St. Agnes: therefore, admitting the length of the degree in the meridian, in the middle point between St. Agnes and the light-house, to be 60850 fathoms, and 61182 for the length of a degree of a great circle perpendicular to it, we get 20′ 47″,4, and 32″,8, for the small arcs which those spaces respectively subtend. These *data*, with the latitude and longitude of St. Agnes, 50° 18′ 27″, and 5° 11′ 55″,7, give the latitude of the light-house = 49° 57′ 44″, and longitude west of Greenwich 5° 11′ 4″,8, in time, 20^{m} 44^{s},3.

This light-house was also observed from the station on Karnminnis. The triangle resulting from that observation, together with the angle at Karnbonellis, is

Karnminnis - 44° 9′ 46″
Karnbonellis - - 98 1 30
Western Light-house 37 48 44; which gives 81342 feet, for the distance between the station Karnbonellis and the Light-house. This distance is said, in the Philosophical Transactions for 1797, p. 501, to be 81348 feet, which differs only 6 feet from the above determination; but it is probable the distance first given is most correct, as the two light-houses appearing nearly in the same line at Karnminnis, was the means of preventing us from clearly distinguishing the apex of either, and it was principally on this account that we preferred the observation made at Pertinney. The agreement however proves, that no inconsistency can be found to obtain with respect to the *data* before given, for settling the situation of this important headland.

In the Philosophical Transactions for 1797, page 502, it is mentioned, that the distance from the spot where the late Mr. BRADLEY made his observations, to the place where his meridian mark was fixed, was 800 feet. But there appears to be some inconsistency in this particular; as Mr. BRADLEY's own words, in an extract of a letter now before me, are, *it was just* 480 *feet.* Adding to this, 24 feet, the distance between the place of the meridian mark and the line joining the centre of the light-houses, we get the distance of the point O, or the place of the Observatory, (see Phil. Trans. 1797, p. 502,) from the line joining the light-houses W, E, = 504 feet; a space corresponding to 5″ of latitude, nearly; therefore, from the trigonometrical operations, we get,

49° 57′ 44″ for the latitude
and 5 11 4,8 for the longitude } of Mr. BRADLEY's station.

Mr. BRADLEY's observations for finding the latitude, were made with a quadrant of one foot radius, the workmanship of Mr. BIRD; they were as follows.

Nine meridional altitudes of the sun's limb, the extreme results of which were 49° 57′ 27″,5 and 49° 57′ 44″, gave for the latitude of the Observatory - - - -	49° 57′ 35″
Six meridional observations of the Pole Star below the Pole, the extreme results of which were 49° 57′ 35″ and 49° 57′ 20″,4, gave for the latitude - - - -	49 57 23,2
Thirteen observations of Arcturus, α Coronæ Borealis, and α Serpentis, the extreme results of which were 49° 57′ 54″,7 and 49° 57′ 2″,7, gave for the latitude - - -	49 57 29
Fifteen observations of α, β, γ Draconis, the extreme results of which were 49° 57′ 22″,2 and 49° 57′ 2″7, gave for the latitude -	49 57 33
The mean of which is -	49 57 30

According to the trigonometrical operations, the latitude is 49° 57′ 44″; there is, therefore, a difference of 14″ between the results; a quantity so large as justly to excite surprise, if it were not generally understood, that much dependance cannot be placed on observations made with an astronomical quadrant precisely similar to that made use of by Mr. BRADLEY. The *extreme* results in the above, differ so widely as to authorise the truth of the supposition on this occasion.

The longitude of the Lizard was determined by the transit of Venus, Sun's eclipse, transit of the Moon, and two emersions of Jupiter's first satellite, as particularly set forth in the Preface to the Nautical Ephemeris of 1791. The conclusions were as follows.

Four transits of the Moon, calculated by Mr. Wales, gave for the longitude - -		$20^m\ 30^s,6$
Two emersions of Jupiter's first satellite, calculated by ditto - - - -		21 14 ,5
Transit of Venus, calculated by	Doctor Maskelyne	20 57 ,0
	Mr. Witchell -	20 56 ,5
	Mr. Wales -	20 57 ,0
Sun's eclipse, calculated by	Mr. Witchell -	20 44 ,5
	Mr. Sejour -	20 45 ,1
	Mr. Euler -	20 59 ,0
	Mr. Lexel -	20 51 ,0
	Mean of the whole -	20 52 ,12

From the trigonometrical operations, we find the longitude in time to be $20^m\ 44^s,3$; there is, therefore, a difference of $7^s,82$ between these different determinations: this is, probably, as near as we could have expected to find it; yet it can scarcely be supposed, that of this difference, more than 2^s can be laid to the account of the survey.

In the Philosophical Transactions for 1797, p. 502, it is observed, that angles were taken at the Lizard Light-house and Naval Signal-Staff, to determine the situation of the *Point* itself. This Point, marked P in the diagram, makes an angle of 2° 23′ 16″ S W, with the parallel to the meridian of St. Agnes at the station on Karnbonellis, and is therefore 636,6 feet from that meridian, and 126394 feet from the perpendicular; therefore 49° 57′ 40″,6 is the latitude
and 5 11 46 the longitude } of the Lizard Point.

Scilly Islands.

To determine the distances of the objects in these islands, from the stations near the Land's End, with sufficient accuracy, proper corrections were made for reducing the horizontal angles to those formed by the chords. On the present occasion, it will be right to use the horizontal, and not the chord angles; the distances from the meridians, and from their perpendiculars, being computed on the supposition of the earth's surface being a plane, which, within the limits of our fixed meridians, may be considered as true.

The angles for finding the distances of these objects are given in the Philosophical Transactions for 1797, p. 503; from whence, and the *data* contained in this Work, we get the bearing of

the *Day-mark* in the Island of St. Martin's from -	St. Buryan	75° 44′ 52″	S W
	Pertinney	71 14 22	S W
	Sennen -	75 30 9	S W

which, combined with the distances of the stations from the meridian of St. Agnes, give

246801
246804
246821 } feet, for the distance of the Day-mark from the meridian of St. Agnes;

and 122409
122410
122414 } feet, for the distance of it from the perpendicular.

The mean of the first is 246809 feet, and the mean of the last 122411 feet; but the latter becomes 122419, because a line drawn from the Day-mark, perpendicular to the meridian of St. Agnes, cuts that meridian eight feet *below* the parallel. Again, we get the bearing of

the Windmill - - -	in the Island of St. Mary, from	Pertinney -	65° 32′ 30″	S W
the Flagstaff of the Fort		Pertinney -	66 53 5	S W

from whence, after a similar correction with that just made, we find the distance of

the Windmill	256304	feet from the meridian, and	143597	feet from the perpendicular of St. Agnes.
the Flagstaff	260152		140876	

From the same page, and the *data* furnished in this work, we also find the bearing of

St. Agnes Light-House from	Sennen -	68° 6′ 54″	S W
	St. Buryan	69 5 56	S W; which gives

265865
265879 } feet, for the distance from the meridian, and

149121
149128 } feet, for the distance from the perpendicular of St. Agnes.

The mean of the first is 265872 feet, and the mean of the last, when corrected, 149133 feet.

With the above data, and also the latitude and longitude of St. Agnes, we get

the latitude of	Day-mark in St. Martin's -	49° 58′ 2″,9
	Windmill, St. Mary's - -	49 54 32,7
	Flagstaff, ditto - -	49 54 59,1
	St. Agnes Light-House[*] - -	49 53 36,8

					In Time.
and longitude west from St. Agnes.	Day-mark	1° 2′ 43″,1	from the meridian of Greenwich. -	6° 14′ 38″,8	$24^{m}58^{s}$,6
	Windmill	1 5 3,2		6 16 58 ,7	25 7 ,9
	Flagstaff	1 6 2,7		6 17 57 ,4	25 11 ,9
	Light House	1 7 27,7		6 19 23 ,4	25 21 ,5

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[*] In the *Requisite Tables*, published by order of the Board of Longitude, the latitude of the Scilly Lights is said to be 49° 56′ 0″, and longitude 6° 46′ 0″. The latitude, according to the survey, is 49° 53′ 36″,8, and longitude 6° 19′ 23″,4. An error of 2′ 23″ in the latitude, may not perhaps be considered extraordinary; but how, in a maritime country, like our own, where chronometers are in such constant use, so great an error as 26′ 37″ (1^{m} $46^{s}\frac{1}{2}$ in time) in the longitude, should have remained undetected, excepting by one person, is surprising. J. HUDDART, Esq. visited the Scilly Isles, having with him a watch made by ARNOLD, and obtained his time at that spot in the island of St. Mary where the body of Sir CLOUDSLEY SHOVEL is said to have been thrown ashore, by means of equal altitudes of the Sun's limb; he then found, comparing his time with that shewn by the watch, that 0^{h} 25^{m} 18^{s} was the difference between the meridians of Greenwich and this spot in St. Mary's. Now St. Agnes Light-house is about 2′ of a degree west of the place to which Mr. HUDDART alludes; therefore, 25′ 18″ + 8″ = 25′ 26″ is the longitude of St. Agnes, through these means; which differs only 4^{s},5 in time from that found by the survey.

The Observatory of his Grace the Duke of MARLBOROUGH, *at Blenheim.*

The staff erected over the quadrant, was observed from White Horse Hill and Whiteham Hill. At the former station, the latter makes an angle of 36° 30′ 13″,5, with the parallel to the meridian of *Dunnose*. The staff, therefore, bears from the parallel 25° 59′ 29″,75 NE.; consequently, its distance from the meridian of Dunnose is 36540 feet, and from the perpendicular 446458 feet. These respectively subtend 5′ 58″,3, and 1° 13′ 21″,4; therefore, the latitude of the Observatory is 51° 50′ 28″,3, and its longitude 9′ 39″,9 from Dunnose: but 1° 11′ 36″ is the longitude of that station; therefore, 1° 21′ 15″,9, or 5′ 25″,2 in time, is the longitude of the Observatory west from Greenwich.

As the meridian of Dunnose passes at no great distance from that of Blenheim, I have deduced the latitude and longitude from the former, to avoid the errors which creep in, when computations are carried on from remote meridians. It may be worth while, however, to show that the extent of those errors would not be great, were the meridian of Dunnose neglected, and the Observatory at Blenheim referred to the meridian of Greenwich.

The distance of White Horse Hill from the meridian of Greenwich is found to be 356050 feet, and from its perpendicular 39425 feet; the bearing of Nuffield, from the parallel at that station, being 89° 59′ 27″ SE. Blenheim will, therefore, be found to bear 26° 55′ 25″ N E from the parallel at White Horse Hill; consequently, its distance from the meridian of Greenwich is 307224 feet, and from its perpendicular 135569 feet. These give the arcs 50′ 12″,4, and 22′ 16″,1; from whence we get 51° 50′ 28″,1 for the latitude, and 1° 21′ 16″ for the longitude, of the Observatory west of Greenwich. Either of these determinations may be taken for the true result, but I shall prefer the first.

Being favoured by his Grace with the latitude and longitude derived from astronomical observations, we have the following comparisons:

				Degrees.	Time.
Latitude	observed	51° 50′ 24″,9	Longitude west from Greenwich.	1° 21′ 6″,0	5^m 24^s,4
	computed	51 50 28 ,1		1 21 15 ,9	5 25 ,1

Observatory at Oxford.

The angle at the station on Shotover, between the Atlas on the top of the Observatory and the parallel to the meridian of Dunnose, is 79° 50′ 51″,75 N W: therefore, its distance from the meridian is 14719 feet, and from the perpendicular 416985 feet. The figure representing Atlas is 33¾ feet *due east* of the Quadrant Room; consequently, no correction will be required in the computed latitude. The space 14719 feet subtends an arc = 2′ 24″,3, and 416985 feet an arc of 1° 8′ 30″,8. These *data*, with the latitude and longitude of Dunnose, give 51° 45′ 38″ for the latitude, and 1° 15′ 29″,2 for the longitude, of the Observatory. As in the former case, with respect to Blenheim, so in the present instance, it is immaterial whether the calculations be carried on from the meridian of Greenwich or that of Dunnose, as differences of only 0″,1 in both the latitude and longitude are found in the results.

The latitude and longitude of this Observatory are given in the *Requisite Tables;* the first is 51° 45′ 38″, and the last 1° 15′ 30″, or 5^m 2^s in time. Doctor HORNSBY, however, has furnished me with what he conceives to be more accurate determinations; from which, and the above, we have the following comparisons:

				Degrees.	Time.
Latitude	observed	51° 45′ 39″,5	Longitude west	1° 15′ 22″,5	5ᵐ 1ˢ,5
	computed	51 45 38 ,0	from Greenwich.	1 15 29 ,2	5 1 ,9

I conclude this article with expressing an opinion, that the coincidence between the computed and, no doubt, accurately observed longitude of this Observatory, affords strong reason for supposing, that the operations at Beachy Head and Dunnose, in 1794, for finding the length of a degree of a great circle perpendicular to the meridian on the earth's surface, were made with the required accuracy.

SECTION THIRD.

Trigonometrical Surveys of the Northern and Western Parts of Kent, the County of Essex, and Parts of the adjoining Counties, Suffolk and Hertford, executed in the Years 1798 and 1799. (See Plate XXXII.)

It will be convenient to treat of the operations carried on in the north of Kent and Essex, before we speak of those executed in the western parts of the former county.

In a former article I have observed, that from the old station at Wrotham, (General ROY's,) the view towards the north is obstructed, and also that it became necessary to select a new one: this station was found to be 205,5 feet from the other; the distance was accurately measured, and afterwards the angle taken at the *old* station, between the staff on Severndroog Tower, Shooters Hill, and the one newly chosen; this angle subtended 94° 19′ 0″,5.

The distance from Severndroog Tower to the old station at Wrotham, is 79960 feet. But, it must be observed, this distance is not precisely the same as that given by General Roy, because an allowance is made for the error in the reduction of the bases, in the surveys of 1787 and 1788.

With the distances 79960 feet and 205,5 feet, and the included angle, 94° 19′ 0″,5, we find the distance of the Flag-staff on Severndroog Tower, from the new station = 79944 feet; with this distance, a part of the following triangles have their sides computed.

ART. XXXVIII. ***Principal Triangles.***

Names of stations.	Observed angles.	Distances of the stations.	Feet.
Wrotham - - Gravesend - - *Severndroog Tower*	° ′ ″ 62 54 38 82 39 21	Gravesend -	45578 71762
Gravesend - - Langdon Hill - - *Severndroog Tower*	95 53 59 53 47 25	Langdon Hill -	44886 88470
Gravesend - - Hadleigh Steeple - *Langdon Hill* - -	34 31 53 43 11 51	Hadleigh Steeple -	64076 37171
Gravesend - - - Hadleigh - - Halstow - - -	30 24 19—21 41 46 32—33 107 49 5— 6 179 59 57	Halstow Steeple -	44839 34064
Gravesend - - Halstow - - - *Gadshill*	31 38 21 24 18 21	Gadshill -	22277 28390
Halstow - - - Hadleigh Steeple - Sheppey Isle - -	59 18 6 —5 49 13 33½—32 31 28 24 —23 180 0 3 ,5	Sheppey -	49409 64387

The distances of Gadshill from Halstow, and from Halstow to the Isle of Sheppey, in the following triangle, viz.

Halstow 128 34 28
Sheppey 18 18 3
Gadshill give the distances between Gadshill and the station in the Isle of Sheppey 70687 and 70685 feet: the mean, 70686 feet, may be taken for the true distance.

Names of stations.	Observed angles.	Distances.	
	° ′ ″		
Hadleigh - -	38 43 29	Southend - - -	27596
Southend - -	119 20 5		
Sheppey			46204

To find the distance between Langdon Hill and the spindle of the weather-cock on Rayleigh Steeple, we have the following quadrilateral.

Langdon Hill 122° 2′ 46″
Gravesend - 64 56 14
Halstow - 111 20 14
Rayleigh - 61 40 46

360 0 0, which gives the distance from the centre of Rayleigh Steeple to the staff on Langdon Hill = 44131 feet; but the point on the top of Rayleigh Tower, over which the instrument was placed, was just 7 feet farther from Langdon Hill than the spindle; therefore, 44131 + 7 = 44138 feet, is the distance between Langdon Hill and the station on the steeple.—The angles in the following triangles,

Hadleigh - 134° 11′ 55″
Sheppey - 16 26 30
Langdon Hill

Langdon Hill 49 8 5
Sheppey - 27 4 46
Rayleigh give the distance of

the *Spindle* on Rayleigh Tower from $\left\{\begin{array}{l}\text{Langdon Hill} = 44131\\ \text{Hadleigh} = 15554\end{array}\right\}$ Feet.

From the preceding quadrilateral, the distance between the spindle on Rayleigh Tower and the station on Langdon Hill, was found = 44131 feet, which is the same as the other determination.

Names of stations.	Observed angles.	Distances.	
	° ′ ″		Feet.
Halstow - - -	95 46 57	Spindle - -	49413
Sheppey - - -	42 6 39		73313
Rayleigh Tower Spindle			
Halstow - - -	35 1 8	Prittlewell - -	46820
Hadleigh - - -	99 3 3		27206
Prittlewell Steeple			
Halstow - - - -	64 16 58	Prittlewell - -	46823
Sheppey - -	55 24 34		51243
Prittlewell			
Halstow - -	73 45 42	Canewden - -	71211
Sheppey - - -	66 39 49		74461
Canewden Steeple - -			
Rayleigh - - -	53 5 0	Canewden - -	31438
Prittlewell - - -	73 41 30		26189
Canewden			
Hadleigh - -	52 52 24	Flagstaff - -	51846
Halstow - - -	86 10 13		34060
Flagstaff of the Garrison, Sheerness			
Severndroog Tower - -	17 48 23	Purfleet Cliff - -	40423
Gravesend - - -	20 22 40		35498
Purfleet Cliff - - -	141 48 57		
	180 0 0		
Rayleigh - - -	97 7 27	Danbury - -	47514
Langdon Hill - -	43 18 2		68746
Danbury Spire			
Severndroog Tower - -	26 24 33	Frierning - -	105659
Langdon Hill - - -	95 25 0		46312
Frierning Steeple - -	58 10 27		
Langdon Hill - -	88 14 19	Frierning - -	46314
Frierning - - -	44 13 19		63270
Rayleigh			

Mean distance from Langdon Hill to Frierning Steeple 46313 feet.

Names of Stations.	Observed angles.	Distances.	
	° ′ ″		Feet.
Frierning - - -	92 15 6	Danbury - -	49020
Langdon Hill - -	45 26 17		68748
Danbury Steeple			
Langdon Hill - -	24 27 23	Signal Staff -	83902
Rayleigh - - -	132 52 23		47408
Signal Staff, Shoebury-ness			
Triptree, old station - -	47 8 50		
Rayleigh - - -	73 45 24		
Frierning			
Triptree, old station, from		Rayleigh Tower - -	74052
		Frierning - -	82860
Triptree - - -	31 59 21		
Danbury - -	124 20 48		
Rayleigh			
Danbury Spire from Triptree Heath - -			36000
Triptree, old station -	100 28 19		
Tillingham Steeple - -	30 14 40		
Danbury Spire			
Tillingham from		Triptree - -	54172
		Danbury - -	70281
Tillingham - -	84 52 34	Peldon - -	42469
Peldon - - -	62 39 36		78803
Danbury - -			
Tillingham - - -	48 58 50	Flagstaff - -	57433
Peldon - - -	83 42 46		43595
Flagstaff on St. Osyth Priory			
Peldon - - -	20 49 10	Thorp - -	64802
Thorp - - -	32 47 18		28612
Flagstaff, St. Osyth Priory -			
Peldon - - -	74 46 5	Stoke - -	63091
Thorp - - -	52 6 31		78171
Stoke Steeple			
Peldon - - -	71 48 20	Great Tey - -	43475
Great Tey - - -	75 51 12		77204
Danbury - -			

Names of the Stations.	Observed angles.			Distances.	
	°	′	″		Feet.
Peldon - - -	46	14	2	Stoke - -	63941*
Great Tey - - -	90	56	9		46182
Stoke					

From a former triangle, the distance between Peldon and Stoke Steeple was found to be 63931 feet; wherefore, 63936 feet, the mean, may be taken for the true distance.

Names of the Stations.	°	′	″	Distances.	Feet.
Thorp - - -	98	52	20	Little Bentley -	20481
Little Bentley - -	53	2	30		
Dover Court - -					42981
Thorp - - -	41	12	53	Little Bentley -	20481
Little Bentley - -	123	30	18		
Peldon - - -					51205
Tillingham - -	96	57	20	West Mersea -	28924
Danbury Spire - -	61	46	57		79173
West Mersea					
Rayleigh - - -	54	27	44	West Mersea -	96701
West Mersea - -	29	13	0		
Danbury - - -					79170
Great Tey - -	52	11	44		
Stoke - - -	45	12	57		
Staircase, St. Mary's Steeple, Colchester					
St. Mary's Steeple from Stoke - - -					36796
Little Bromley - -	54	11	22	Little Bromley - -	44356
Stoke - - -	47	58	26		
St. Mary's, Colchester -					33706
Dover Court - -	18	58	19	Tattingstone -	38946
Stoke - - -	14	53	50		49250
Tattingstone					
Thorp - - -	37	52	49	Tattingstone -	50690
Stoke - - -	39	12	4		49245
Tattingstone					
Dover Court - -	50	26	54	Falkenham - -	31651
Rushmere - - -	38	25	20		39270
Falkenham Steeple					

The distance from Dover Court Steeple to Stoke Steeple is 84425 feet, and from Rushmere Steeple to Stoke Steeple 75955 feet; the included angle at Dover Court Steeple is 62° 38′ 20″. These give the distance of Dover Court Steeple from Rushmere, 50921 feet.

Names of Stations.	Observed angles.	Distances.	
	° ′ ″		Feet.
Dover Court	43 40 51	Tattingstone	38946
Rushmere	49 46 9		35232
Tattingstone			
Dover Court	25 55 13	Woodbridge	59894
Rushmere	96 25 30		26346*
Woodbridge Steeple	57 39 17		
	180 0 0		
Falkenham	41 25 50	Woodbridge	33761
Rushmere	58 0 10		26342*
Woodbridge			
Falkenham	48 42 0	Butley	45013
Woodbridge	83 10 0		34058
Butley Steeple			
Falkenham	21 58 1	Orford Light House	60589
Butley	116 14 59		25207
Orford Light House			
Rushmere	62 45 1-0	Otley	29238
Woodbridge	63 30 1-0		29044
Otley Steeple	53 45 0		
	180 0 2		
Rushmere	40 25 30	Henley	21211
Otley	46 25 0		18988
Henley Steeple	93 9 30		
	180 0 0		
Dover Court	12 43 40	Obelisk	26766
Rushmere	13 22 10		25503
Obelisk, Woolverstone Park			
Rushmere	61 35 58	Copdock	28984
Copdock Steeple	53 5 10		
Obelisk			28057
Rushmere	85 25 0	Henley	21209
Copdock	37 46 0		34520
Henley	56 49 0		
	180 0 0		

Names of Stations.	Observed angles.	Distances.	
	° ′ ″		Feet.
Henley	58 32 42—40	Naughton	45518
Copdock	74 30 11—10		40294
Naughton Steeple	46 57 11—10		
Naughton	74 24 2	Lavenham	35867
Stoke	45 58 58		48039
Lavenham Steeple	59 37 0		
Lavenham	67 48 30	Bulmer	36837
Stoke	44 59 10		48248
Bulmer Steeple	67 12 20		
Lavenham	47 34 25	Glemsford	25746
Bulmer	44 18 40		27086
Glemsford Steeple			
Lavenham	18 22 0	Topplesfield	67962
Bulmer	142 15 20		34983
Topplesfield			
Lavenham	51 36 40	Twinestead	43349
Stoke	58 8 10		40006*
Twinestead Steeple			
Stoke	50 4 48	Twinestead	40006*
Great Tey	56 15 56		36895
Twinestead			
Frierning	156 42 10	Southweald	30138
Danbury	8 50 0		77622
Southweald Steeple			
Danbury	151 18 36	Gallywood	26097
Triptree, old Station	12 0 34		60211
Gallywood Common			
Triptree, old Station	37 41 44	Pleshley	63213
Gallywood	75 13 56		39973
Pleshley Steeple			
Danbury	55 31 11	Pleshley	48455
Gallywood	91 54 46		39964
Pleshley			
Gallywood	15 45 30	High Easter	47767
Pleshley	114 49 0		14293
High Easter Steeple			

Names of stations.	Observed angles.	Distances.	
	° ′ ″		Feet.
Danbury - -	12 4 30	Hatfield Broad Oak -	85096
Pleshley - - -	152 53 10		39058
Hatfield Broad Oak Steeple			
Danbury - - -	25 45 6	Thaxted - -	101330
High Easter - -	29 43 54		53429
Thaxted Spire			
Hatfield Broad Oak -	54 20 51	Beauchamp Roding -	24853
Pleshley - - -	39 25 0		31806
Beauchamp Roding Spire			

The angle observed from the station on Danbury Steeple, between Hatfield Broad Oak and Thaxted, was 30° 33′ 40″; this, with the including sides, 85094 and 101330 feet, gives the following triangle:

Danbury - 30° 33′ 40″
Hatfield Broad Oak 92 24 0
Thaxted - 57 2 20, which gives the distance between Thaxted and Hatfield Broad Oak = 51566 feet.

Danbury - - -	27 24 19	Stoke - -	122630
Peldon - - -	118 2 28		63951
Stoke			

Again, the angle observed at Danbury, between Thaxted and Stoke was 66° 43′ 8″; this, with the sides which form it, Danbury and Thaxted, Danbury and Stoke, gives the following triangle:

Danbury - 66° 43′ 8″
Stoke - - 48 25 16
Thaxted - 64 51 36, from which we find 124430 feet, for the distance from Thaxted to Stoke.

The angle at Lavenham Steeple, between Stoke and Thaxted, was likewise observed, and found to be 89° 10′ 30″, which, with the distances of these latter stations from Lavenham, 48039 and 124430 feet, gives

Lavenham - 89° 10′ 30″
Stoke - - 68 7 0
Thaxted - 22 42 30, from which we find 115480 feet to be the distance from Thaxted Spire to Lavenham Steeple.

The angle at Danbury, between Southweald and Hatfield Broad Oak, was found to be 54° 44′ 30″. The distances from Danbury to Southweald and Hatfield Broad Oak have been already found, the former being 77622 feet, and the latter 85096 feet; from these we get the triangle,

Danbury - 54° 44′ 30″
Southweald - 67 42 5
Hatfield Broad Oak 57 33 25, which gives 75104 feet, for the distance between Hatfield Broad Oak and Southweald Steeples.

In order to connect the preceding triangles with those carried on for the survey of the south-western part of Essex, and of Hertfordshire, stations were selected on Hampstead Heath, and on Highbeech in Epping Forest, to which the great theodolite was taken, as related in the article detailing the particulars of the operations in 1799. The triangles making this connection are the following. The first, namely,

Severndroog Tower 28° 58′ 10″
Southweald - 94 49 5
Langdon Hill - 56 12 45, is had from the included angle at Severndroog Tower, 28° 58′ 10″, and the sides Severndroog Tower and Southweald, Severndroog Tower and Langdon Hill: the first is 73787 feet, and the second 88470 feet. From these *data*, we obtain the distance between the station on Langdon Hill and that on Southweald Steeple = 43001 feet.

Names of Stations.	Observed angles.	Distances.	
	° ′ ″		Feet.
Severndroog Tower -	24 24 35	Brentwood -	78553*
Langdon Hill - -	62 26 39		36616
Brentwood Steeple			
Severndroog Tower -	4 33 29	Brentwood -	78553*
Southweald - -	125 53 12		7706
Brentwood			

Foot of the cross on the dome of St. Paul's from the station on Severndroog Tower 39962*.
Phil. Trans. for 1787. p. 250.

Severndroog Tower -	33 53 4	Highbeech -	71534
St. Paul's - - -	51 24 12		61919
Highbeech			
Severndroog Tower -	44 34 28	Southweald -	73795*
Highbeech - - -	69 53 13		55156
Southweald			

From the last triangle, we find the distance from Severndroog Tower to the station on Southweald Steeple to be 73795 feet; this, it will be perceived, is deduced from the distance between the cross on the dome of St. Paul's and Severndroog Tower; but 73791 feet has been found by the triangle, which is derived from the distance between the latter station and Wrotham. A difference of 4 feet on such a distance, all things considered, is not a large quantity.

Names of Stations.	Observed Angles.	Distances.	
	° ′ ″		Feet.
Severndroog Tower -	49 8 1	Brentwood -	78558*
Highbeech - - -	71 16 44		62727
Brentwood Spire			
Severndroog Tower -	51 24 12	Hampstead Heath -	64855
Highbeech - - -	58 29 19		59455
Hampstead Heath			
Highbeech - - -	24 36 5	St. Paul's - -	61919
Hampstead - -	83 1 11		25966
St. Paul's			

As it became necessary to ascertain the situation of a high building near Berkhamstead, which, for distinction sake, I shall style the Gazebo, the instrument was removed from the station on Highbeech, to another farther west of it, as some trees obstructed the view of this object from the former. To get the distance from St. Paul's to this new station, the distance between it and the old one was measured, and found = 460 feet: the angles in the following triangle were also observed.

Highbeech, old station 66° 32′ 47″
Highbeech, new station 113 3 46
St. Paul's which gives the distance from

St. Paul's to the new station 61738 feet.

Highbeech, new station -	105 21 44	Gazebo - -	49631
Berkhamstead Gazebo -	41 55 23		
St. Paul's - -			88872
Southweald - -	16 46 15	Epping Windmill -	46717
Highbeech, old station -	52 16 51		17042*
Stand of Epping Windmill			
Severndroog Tower -	10 8 44	Epping Windmill -	81891
Highbeech - - -	122 10 45		17043*
Stand of Epping Windmill			

Names of Stations.	Observed angles.			Distances.	
	°	′	″		Feet.
Highbeech, old station -	99	19	16	Epping Windmill -	17049
Berkhamstead Gazebo -	17	41	25		55567
Stand of Epping Windmill					

At the new station on Highbeech, the angle between the staff on the Gazebo at Berkhamstead and the old station was observed, and found to be 141° 45′ 50″. This angle, with the measured distance between the stations, and also the distance from the Gazebo to the new station, which are respectively 460 and 49628 feet, gives 49987 feet, for the distance between the new station on Highbeech and Berkhamstead Gazebo.

Hatfield Broad Oak Steeple -	59	1	0	Hatfield Broad Oak -	87140
Berkhamstead Gazebo -	43	12	50		60219
Epping Windmill -					
Berkhamstead Gazebo -	24	9	55	Naseing - -	39173
Hatfield Broad Oak - -	17	19	38		53844
Naseing Steeple					
Hatfield Broad Oak -	107	39	57	Henham on the Mount	39265
Berkhamstead Gazebo -	20	41	30		105890
Henham on the Mount Steeple					
Hatfield Broad Oak -	71	28	54	Thorley - -	24275
Henham on the Mount -	36	6	30		39058
Thorley Steeple					
Henham on the Mount -	35	25	0	Atterbury - -	37882
Thorley Steeple - -	69	33	0		23430
Atterbury Steeple					
Henham on the Mount -	87	20	0	Rickling - -	17816
Thorley - - -	24	57	50		42169
Rickling Steeple					
Henham on the Mount -	20	54	0	Elmdon - -	45275
Rickling - -	146	35	0		29327
Elmdon Steeple					

The angle between Albury and Elmdon Steeples was observed, at Henham on the Mount, and found to be 72° 47′ 38″. The distances from the former stations to the latter are 37882 and 45275 feet, which give the following triangle:

Henham - 72° 47′ 38″
Albury - 60 28 27
Elmdon - - 46 43 35, from whence we get the distance between Albury and Elmdon = 49701 feet.

Names of Stations.	Observed angles.	Distances.	
	° ′ ″		Feet.
Henham on the Mount -	106 30 50	Thaxted - -	22988
Elmdon - - - -	23 2 40		56302
Thaxted Steeple			
Elmdon - - -	71 54 10	Balsham - -	55262
Thaxted - - -	53 18 44		65504
Balsham Steeple			
Elmdon - - -	23 38 46	Babraham Mount -	43559
Balsham - - -	48 40 38		23251
Babraham Mount Station			
Elmdon - - - -	29 46 30	Triplow - -	24806
Babraham Mount - - -	32 56 30		29185
Triplow Steeple			

The angle at Henham on the Mount, between Hatfield Broad Oak and Thaxted Steeples, is 109° 10′ 44″; and the distances of the latter stations from the former one are 39266 and 22988 feet; from these *data* we have the triangle,

Henham - - 109° 10′ 44″
Thaxted - - 45 56 29
Hatfield Broad Oak - 24 52 47, which gives 51608 feet for the distance of Thaxted from Hatfield Broad Oak.

Hatfield Broad Oak - -	51 9 50	High Easter -	24858
Beauchamp Roding - -	64 26 10		21460
High Easter Steeple			
Severndroog Tower - -	21 6 9	Hornchurch - -	50989
Langdon Hill - -	24 10 20		44832*
Hornchurch Steeple			
Langdon Hill - - -	77 57 33	Hornchurch -	44837*
Gravesend - - - -	50 59 0		56438
Hornchurch Steeple			

Names of Stations.	Observed angles.	Distances.	
	° ′ ″		Feet.
Gravesend	24 32 30	Purfleet Cliff	35517
Hornchurch	31 26 22		28282
Purfleet Cliff Station			
Severndroog Tower	39 44 2	Barking	25383
Hornchurch	27 16 44		35404
Staircase of Barking Steeple			
Severndroog Tower	39 41 6	Westham	28046
St, Paul's	44 15 27		25662
Westham Steeple			

Art. xxxix. *Secondary Triangles.*

St. Paul's from Severndroog Tower 39962 feet.

Severndroog Tower	13 1 7	Limehouse	26371
St. Paul's	22 36 13		15456
Limehouse Steeple			
Severndroog Tower	9 15 30	Chigwell	57757
Highbeech	32 36 38		17242
Chigwell Steeple			
Severndroog Tower	11 57 6	Billericay	100110
Frierning	74 34 30		21506
Billericay Chapel			
Westham Steeple	45 58 0	Station	15640
Staircase of Barking Steeple	68 35 0		12077
Station on Bank of the Thames			
Station on Bank of the Thames	41 21 0	Perry's Mast House	13120
Westham Steeple	56 15 0		10424
Perry's Mast House			
Hornchurch	14 31 20	Chimney	33236
Staircase of Barking Steeple	68 52 0		9005
Chimney of Public House at Barking Creek			
Purfleet Cliff	54 57 0	Guzzard	21002
Hornchurch	46 40 0		23638
Guzzard Station			

Names of Stations.	Observed angles.			Distances.	
	°	′	″		Feet.
Purfleet Cliff	34	11	30	Rainham	16387
Hornchurch	32	1	0		17370
Rainbam Steeple					
Purfleet Cliff	81	9	0	Belvidere	16212
Hornchurch	31	50	50		30369
Lord Eardley's, Belvidere					
Purfleet Cliff	42	18	30	Cold Harbour	10971
Rainham	41	45	0		11090
Station at Cold Harbour					
Guzzard	56	8	20	Aveley Mill	21436
Hornchurch	56	43	20		21302
Aveley Mill					
Purfleet Cliff	34	2	40	Valence Tree	36305
Hornchurch	95	3	40		20404
Valence Tree					
Gravesend	79	39	30	Chadwell	17008
Severndroog Tower	13	41	10		70717
Cbadwell Steeple					
Gravesend	35	39	0	Greys	18479
Chadwell Steeple	79	31	20		10953
Greys Steeple					
Gravesend	37	46	0	Flagstaff	22880
Chadwell Steeple	94	24	0		14054
Flagstaff on Mr Button's House					
Gravesend	51	43	0	West Thurrock	22457
Chadwell Steeple	80	2	30		17897
West Tburrock Steeple					
Gravesend	49	8	30	Horndon	33382
Hornchurch	36	7	5		42833
Horndon Spire					
Gravesend	18	52	0	West Tilbury	5617
Chadwell	59	26	30		14956
West Tilbury Steeple					
Gravesend	69	31	27	Northfleet	8755
Chadwell	30	27	42		16179
Nortbfleet Steeple					

Names of Stations.	Observed angles.	Distances.	
	° ′ ″		Feet
Gravesend	57 16 0	East Tilbury	16328
Chadwell	59 13 30		15987
East Tilbury Flagstaff			
Chadwell	51 23 0	Station	25526
Mr. Button's Flagstaff	95 22 30		20031
Station near Ockendon			
Mr. Button's Flagstaff	54 20 30	Orset	17360
Station near Ockendon	54 54 30		17240
Orset Steeple			
Gravesend	45 9 13	Fobbing	41433
Halstow	62 0 10		33270
Fobbing Steeple			
Hadleigh Station	65 31 12	Fobbing	26221
Halstow	45 48 50		33279
Fobbing Steeple			
Halstow	101 39 27	Thundersley	41342
Gravesend	37 16 40		
Thundersley Steeple			
Halstow	7 53 10	Hadleigh	5713
Hadleigh	117 13 23		37028
Hadleigh Spire			
Hadleigh	89 20 40	Leigh	15735
Halstow	24 54 27		37357
Leigh Steeple Staircase			
Halstow	74 23 21	Leigh	37359
Sheppey Station	42 26 8		53325
Leigh Steeple Staircase			
Halstow	13 17 45	Sheerness	41434
Sheppey	46 5 47		13063
Sheerness Fort Flagstaff			
Hadleigh	38 43 29	South Church	71211
Sheppey	21 56 26		74461
South Church Steeple			
Hadleigh	11 6 2	Prittlewell	27208
Sheppey Station	80 16 46		5314
Prittlewell Steeple			

Names of Stations.	Observed angles.	Distances.	Feet.
	° ' "		
Canewden Steeple	45 50 0	Little Wakering	23850
Prittlewell	60 46 30		19603
Little Wakering Steeple			
Canewden	64 27 0	Bank	32739
Prittlewell	67 46 30		31908
Bank Flagstaff			
Prittlewell	33 10 0	Shoebury-ness	21208
Station on Bank	39 20 30		18302
Shoebury-ness			
Canewden	32 51 30	Foul-ness	35481
Bank Flagstaff	81 20 0		19473
Foul-ness Chapel			
Rayleigh	47 28 6	Signal Staff	71622
Peldon	43 45 33		76311
Foul-ness Signal Staff			
Tillingham Steeple	139 21 10	Signal Staff	13990
Peldon	9 44 29		53860
Signal Staff, Tillingham Grange			
Tillingham	43 27 58	Signal Staff	18802
Peldon	24 10 18		31591
Signal Staff, Bradwell Point			
Tillingham	31 2 40	Brightlingsea	56094
Peldon	100 56 20		29463
Brightlingsea Steeple			
Tillingham	39 48 40	Tolesbury	24611
West Mersey Steeple	57 33 13		18673
Tolesbury Steeple			
Tillingham	63 55 6	Althorn	31946
Triptree, old Station	35 34 3		49330
Althorn Church			
Tillingham	26 32 10	Burnham	26664
Althorn	55 49 0		1440
Burnham Steeple			
Tillingham	47 33 35	Toleshunt	3654
Peldon	56 33 25		3231
Toleshunt Major Steeple			

Names of stations.	Observed angles.	Distances.	
	° ′ ″		Feet.
Prittlewell Steeple	33 10 0	Signal Staff	21208
Bank Flagstaff	39 20 30		18302
Signal Staff, Shoebury-ness			
Triptree, new Station	38 5 18	Maldon	19425
Danbury	30 11 27		23829
Maldon Spire			
Triptree, new Station	36 48 30	Purleigh	36118
Danbury	72 9 0		22734
Purleigh Steeple			
Danbury	17 47 32	Steple	49647
Purleigh Steeple	148 16 30		28850
Steple Steeple			
Danbury	26 17 40	Hockley	41401
Canewden	51 8 0		23555
Hockley Steeple			
Danbury	27 21 50	Hockley	41400
Rettenden	109 22 0		20170
Hockley Steeple			
Danbury	53 39 40	Rettenden	30079
Canewden	35 25 0		41810
Rettenden Steeple			
Rettenden	34 41 0	Stow, St. Mary's	23571
Canewden	30 53 0		26131
Stow, St. Mary's Steeple			
Rayleigh	71 51 18	Rettenden	20760
Langdon Station	27 38 45		42526
Rettenden Steeple			
Rayleigh	51 8 10	Runwell	21207
Langdon	28 10 20		34975
Runwell Steeple			
Danbury	48 57 22	Burghstead	53254
Rayleigh	72 39 17		42079
Great Burghstead Steeple			
Danbury	59 11 7	Hanningfield	17666
Gallywood Station	41 40 10		22822
East Hanningfield Steeple			

Names of stations.	Observed angles.	Distances.	
	° ′ ″		Feet.
Frierning Steeple	36 7 48	Stock	16826
Danbury	15 38 36		36793
Stock Steeple			
Triptree, old Station	18 38 11	Southminster	55075
Tillingham Steeple	83 33 14		17711
Southminster Steeple			
Peldon Steeple	97 35 31	Layer Marney	20180
Tillingham	23 54 4		49369
Layer Marney Steeple			
Peldon	80 20 6	Signal Staff	60701
Tillingham	61 39 24		67990
Signal Staff, St. Osyth Point			
Thorp Steeple	143 7 36	Signal Staff	21517
Little Bentley	18 54 29		39844
Great Clackton Signal Staff			
Thorp	71 35 55	Great Clackton	18920
Peldon	16 58 13		61508
Great Clackton Steeple			
Dover Court Steeple	24 36 48	Finton	38998
Thorp	92 26 41		16257
Finton Steeple			
Dover Court	39 16 34	Signal Staff	34686
Thorp	70 11 16		23340
Finton Signal Staff			
Dover Court	53 15 26	Walton	26275
Thorp	47 52 22		28389
Walton Tower or Sea-mark			
Dover Court	133 57 30	Cupola	15085
Thorp	13 29 57		46517
Cupola, Landguard Fort			
Thorp	46 16 17	Ardleigh	47494
Peldon	47 1 34		46901
Ardleigh Steeple			
Peldon	106 10 16	Frating	35433
Great Tey Steeple	32 32 11		63274
Frating Steeple			

Names of Stations.	Observed angles. °	′	″	Distances.	Feet.
Thorp	30	17	55	Thorrington	23890
Little Bentley Steeple	90	41	23		12053
Thorrington Steeple					
Dover Court	22	10	12	Kirby	30343
Thorp	59	48	37		13247
Kirby Steeple					
Dover Court	33	8	12	Little Oakley	12216
Kirby Steeple	18	22	0		21193
Little Oakley Steeple					
Tillingham	38	45	0	Toleshunt Major	36541
Layer de la Hay Steeple	45	28	0		32082
Toleshunt Major Steeple					
Dover Court	16	48	13	Brantham	42590
Tattingstone Steeple	98	26	0		12447
Brantham Steeple					
Dover Court	30	52	58	Harkstead	19946
Rushmere Steeple	16	51	2		35319
Harkstead Steeple					
Dover Court	33	17	30	Arwarton	13053
Tattingstone	14	20	0		28941
Arwarton Steeple					
Tattingstone	66	10	0	Bradfield	20998
Arwarton Steeple	43	12	0		28059
Bradfield Steeple					
Dover Court	72	48	50	Harwich	8881
Rushmere	9	58	0		49036
Harwich Spire					
Dover Court	56	48	20	Hollesley	57475
Rushmere	67	58	30		51881
Hollesley Steeple					
Dover Court	47	7	40	Shottisham	52205
Rushmere	68	4	20		41224
Shottisham Steeple					
Dover Court	65	59	15	Bawdsey	46177
Rushmere	52	42	10		53024
Bawdsey Steeple					

Names of Stations.	Observed angles.			Distances.	
	°	′	″		Feet.
Dover Court - -	52	48	11	Felixstow - -	28926
Woodbridge Steeple -	28	31	0		48262
Felixstow Signal Staff					
Dover Court - -	45	12	55	Bawdsey - -	42265
Woodbridge - -	44	53	0		42510
Bawdsey Signal Staff					
Rushmere - - -	45	41	10	Orford - -	75267
Falkenham Steeple -	103	52	0		55472
Orford Steeple					
Woodbridge - -	28	28	0	Rendlesham -	21686
Butely Steeple - -	34	37	0		18204
Rendlesham Steeple					
Butely - - -	153	23	0	Orford - -	15762
Rendlesham - -	12	20	0		33057
Orford Steeple					
Dover Court - -	8	2	6	Kesgrave - -	7371
Rushmere - -	66	54	0		48505
Kesgrave Steeple					
Dover Court - -	34	14	16	Waldringfield -	45360
Rushmere - - -	62	15	50		28841
Waldringfield Steeple					
Dover Court - -	30	58	10	Whertstead - -	40331
Kesgrave Steeple - -	56	8	30		24993
Whertstead Steeple					
Falkenham - -	30	59	0	Nacton - -	25098
Rushmere - - -	36	2	50		21959
Nacton Steeple					
Dover Court - -	13	29	58	Capel - -	55220
Stoke - - -	22	45	20		33325
Capel Steeple					
Stoke - - -	24	14	18	Hintlesham - -	40790
Capel Steeple - -	103	0	34		17186
Hintlesham Steeple					
Stoke - - -	29	43	10	Bildestone - -	42238
Lavenham Steeple - -	61	31	40		23821
Bildestone Steeple					

Names of Stations.	Observed angles.			Distances.	
	°	′	″		Feet.
Stoke	33	53	40	Aldham	32055
Bildestone Steeple	48	50	10		23746
Aldham Steeple					
Lavenham	29	39	50	Hadleigh	42673
Naughton	93	17	20		21154
Hadleigh Spire					
Lavenham	31	40	10	Lindsey	25138
Naughton Steeple	42	21	50		19587
Lindsey Steeple					
Stoke	23	7	30	Newton	27153
Lavenham	24	48	40		25413
Newton Steeple					
Stoke	27	1	0	Grotton	19660
Newton	42	49	0		13140
Grotton Steeple					
Bulmer Steeple	67	27	40	Waldingfield	25637
Glemsford Steeple	53	37	50		29407
Waldingfield Steeple					
Lavenham	56	59	0	Acton	14065
Glemsford	33	6	50		21097
Acton Steeple					
Lavenham	26	13	10	Beauchamp	41546
Bulmer	91	21	20		18360
Beauchamp Church, St. Paul's					
Lavenham	12	31	50	Hedingham Castle	59359
Topplesfield Steeple	52	7	20		16316
High western part of Hedingham Castle					
Lavenham	26	57	0	Ridgewell	62325
Bulmer	123	32	0		33886
Ridgewell Steeple					
Stoke Steeple	101	57	15	Langham	17904
Naughton Steeple	20	32	45		49907
Langham Steeple					
Stoke Steeple	21	17	20	Great Horksley	13615
Great Tey Steeple	8	23	40		33859
Great Horksley Steeple					

Names of Stations.	Observed angles.			Distances.	
	°	′	″		Feet.
Stoke	71	21	0	Great Horksley	13615
Twinestead Steeple	19	53	0		37819
Great Horksley Steeple					
Stoke	44	24	0	Mount Bures	29360
Great Horksley	109	43	0		21821
Mount Bures Steeple					
Stoke	62	30	40	Earles Colne	47756
St. Mary's, Colchester	70	48	0		44860
Earles Colne Steeple					
Great Tey	24	47	20	West Bergholt	21357
St. Mary's Colchester	33	14	0		16339
West Bergholt Steeple					
Danbury	6	6	0	Braxted	41358
Great Tey	6	56	40		36349
Braxted Steeple					
Great Tey	4	37	24	Kelvedon	36349
Braxted Steeple	11	43	36		10407
Kelvedon Steeple					
Great Tey	30	14	50	Messing	22390
Kelvedon	58	32	0		13223
Messing Steeple					
Great Tey	51	43	10	East Thorp	15462
Kelvedon	36	4	0		20616
East Thorp Steeple					
Danbury	50	48	0	Black Notley	51487
Triptree, new station	85	12	30		40039
Black Notley Steeple					
Danbury	23	51	34	Witham	35850
Triptree, old station	77	29	26		14852
Witham Steeple					
Danbury	47	47	25	Tarling	31874
Triptree, old station	58	17	35		27751
Tarling Spire					
Danbury	51	43	0	Braintree	58918
Triptree, old station	90	45	50		46252
Braintree Steeple					

Names of Stations.	Observed angles.			Distances.	
	°	′	″		Feet.
Triptree, new station	56	13	54	Feltstead	63574
Gallywood station	64	47	51		58409
Feltstead Steeple					
Danbury	26	31	30	Braintree	58918
Feltstead Steeple	73	49	10		27392
Braintree Steeple					
Danbury	17	39	30	Feltstead	60336
Pleshley Steeple	116	15	43		20409
Feltstead Steeple					
Triptree, new station	27	23	20	Hatfield Peverel	20267
Danbury	27	35	30		20132
S. Spire of Hatfield Peverel Abbey					
Pleshley	68	3	0	Great Leigh	24915
Feltstead	64	21	0		25635
Great Leigh Steeple					
Danbury	41	29	44	Great Baddow	16345
Pleshley	16	39	0		37796
Great Baddow Steeple					
Danbury	23	59	8	Chelmsford	24110
Pleshley	20	21	0		28186
Chelmsford Spire					
Danbury	32	38	36	Whittle	33552
Pleshley	41	51	20		27122
Whittle Steeple					
Danbury	19	16	20	Willingale Spain	60488
Hatfield Broad Oak	35	29	15		34390
Willingale Spain Steeple					
Pleshley	36	12	0	Roxwell	19937
Gallywood station	26	14	36		26630
Roxwell Steeple					
Pleshley	103	44	45	White Roding	33489
Gallywood station	34	9	50		57926
White Roding Steeple					
Southweald Steeple	27	51	51	Doddinghurst	17880
Frierning Steeple	30	14	50		16590
Doddinghurst Steeple					

Names of stations.	Observed angles.			Distances.	
	°	′	″		Feet.
Southweald - -	3	49	0	Theydon - -	31098
Epping Windmill -	7	31	0		15824
Theydon Mount Steeple					
Southweald - -	49	13	0	Navestock - -	9656
Theydon Mount Steeple -	16	26	0		25846
Navestock new Windmill					
Southweald - - -	5	18	0	Theydon Garnon -	37107
Theydon Mount - -	149	43	0		6797
Theydon Garnon Steeple					
Theydon Mount - -	111	19	30	Havering - -	21090
Theydon Garnon - -	53	38	0		24397
Havering Steeple					
Severndroog Tower -	5	40	20	Cupola - -	52260
Highbeech Station -	14	49	4		20197
Cupola of a house at Woodford					
Southweald - -	36	20	20	Ruins - -	51340
Highbeech - -	65	36	20		33405
Ruins near Ilford					
Highbeech - -	102	38	0	Cheshunt - -	34702
St. Paul's - -	26	2	0		77151
Cheshunt Station					
Berkhamstead Gazebo	25	59	0	Hunsdon - -	43157
Naseing Steeple - -	88	51	24		18911
Hunsdon Steeple					
Naseing - - -	94	35	0	Broxbourn -	13899
Hunsdon Steeple - -	34	41	0		24348
Broxbourn Steeple					
Berkhamstead Gazebo -	8	33	28	Harlow Steeple -	62528
Hatfield Broad Oak Steeple	20	11	11		26964
Harlow Steeple					
Hatfield Broad Oak -	19	44	10	Sabridgeworth -	21054
Naseing - - -	11	48	5		34763
Sabridgeworth Steeple					
Thorley Steeple - -	45	17	0	Great Hadham -	15253
Albury Steeple - -	40	29	0		16995
Great Hadham Steeple					

ART. XL. *Principal Triangles for the Survey of the Western Part of Kent. Plate* XXXIII.

Frant Steeple from Botley Hill 90362,4 feet.

Names of stations.	Observed angles.			Distances.	
	°	′	″		Feet.
Frant Steeple - -	22	17	10	Sevenoaks - -	58492
Botley Hill - -	32	52	47		44032
Sevenoaks old Windmill					
Frant - - -	22	17	10	Chiddingstone -	42875
Sevenoaks Windmill -	40	52	50		24858
Chiddingstone Steeple -					
Frant - - -	35	2	17	Mount Sion - -	57874
Chiddingstone - -	97	43	43		33532
Mount Sion Station					
Frant - - -	31	28	30	East Peckham -	58964
Mount Sion - -	76	9	30		31707
East Peckham Steeple					
Mount Sion - -	48	14	0	Tudely Steeple -	31363
East Peckham - -	65	11	0		25772
Tudely Steeple					
Botley Hill - -	11	1	48	Seal Chart - -	59563
Sevenoaks Windmill -	141	42	12		18388
Seal Chart Station					
Seal Chart - -	74	10	0	Tunbridge - -	26851
Sevenoaks Windmill -	66	49	0		28101
Tunbridge Steeple					
Seal Chart - -	78	1	0	Otford Mount -	20397
Sevenoaks Windmill -	54	39	0		24462
Station on Otford Mount					
Sevenoaks Windmill - - -	69	27	0	Silverden Farm -	28395
Otford Mount - -	61	24	0		30284
Silverden Farm Station					

Norwood from Severndroog Tower 39155 feet.

Names of stations.	Observed angles.			Distances.	
Norwood - -	53	7	40	Well Hill - -	57393
Severndroog Tower -	84	8	0		46155
Well Hill Station					

Names of stations.	Observed angles.			Distances.	
	°	′	″		Feet.
Severndroog Tower -	55	4	14	Crayford - -	26479
Well Hill - -	35	0	32		37840
Crayford Steeple					
Well Hill - -	77	37	40	Ash - -	34738
Crayford - - -	48	8	40		45555
Ash Steeple					
Ash - - -	53	7	10	Northfleet - -	32237
Crayford - - -	44	32	4		36767
Northfleet Steeple					
Ash - - -	15	30	4	Gravesend - -	32664
Northfleet - -	85	1	8		8762
Gravesend Station					
Ash - - -	47	33	30	Belvidere - -	56308
Northfleet - -	97	53	40		41951
Lord Eardley's, Belvidere					

Gravesend from Halstow 44836 feet.

Gravesend - -	31	38	20	Gadshill - -	22275
Halstow - - -	24	18	20		28388
Gadshill Station					
Halstow - - -	128	34	28		
Sheppey - -	18	18	3		
Gadshill				Sheppey from Gadshill	70686
Sheppey - - -	88	18	0	Stockbury -	43144
Hernhill Steeple - -	37	2	0		71603
Stockbury Steeple					
Frinstead Steeple -	65	27	18	Hernhill - -	57820
Sheppey - - -	64	9	24		58439
Hernhill Steeple					

ART. XLI. *Secondary Triangles.*

Frant Steeple - -	26	37	20	Bidborough -	26066
Botley Hill Station -	9	52	49		68071
Bidborough Steeple					
Frant - - -	20	52	0	Station - -	27227
Chiddingstone Steeple -	29	5	0		19951
Station near Bidborough Church					

Names of stations.	Observed angles.			Distances.	
	°	′	″		Feet.
Frant	104	24	36	Remarkable Tree	24226
Botley Hill	13	40	51		99201
Remarkable Tree near Kibben's Cross					
Frant	46	32	0	Cowden	41943
Station near Bidborough Church	93	3	30		30485
Cowden Steeple					
Station near Bidborough Church	76	2	0	Mount Sion	32194
Chiddingstone Steeple	68	42	0		35532
Mount Sion Station					
Station near Bidborough Church	20	37	0	Leigh	11241
Mount Sion	10	21	0		22031
Leigh Steeple					
Frant	10	5	30	Ide Hill	62547
Chiddingstone	149	38	30		21689
Ide Hill Station					
Chiddingstone	67	42	0	Edenbridge	18639
Ide Hill	49	43	0		22606
Edenbridge Steeple					
Seal Church Steeple	57	45	0	Sevenoaks	15132
Otford Mount	46	5	0		17766
Sevenoaks Steeple					
Mount Sion Station	20	36	0	Hadlow	25291
Peckham Steeple	47	56	0		11987
Hadlow Steeple					
Seal Chart Station	50	45	0	Sundrich	29804
Otford Mount	86	11	0		23131
Sundrich Steeple					
Otford Mount	94	17	0	Seal	9705
Silverden Station	17	20	0		32484
Seal Steeple					
Well Hill Station	17	40	40	Ketson Common Windmill	26538
Norwood	14	5	22		33103
Windmill, Ketson Common					
Well Hill	56	39	0	Flagstaff	28273
Severndroog Tower	37	39	0		38664
Flagstaff on Hayes Common					

Names of Stations.	Observed angles. °	′	″	Distances.	Feet.
Well Hill - - -	14	19	0	Hayes - -	31069
Bromley - - -	51	35	0		9805
Hayes Steeple					
Bromley - -	45	18	0	Lewisham - -	19640
Severndroog Tower -	51	28	0		17846
Lewisham Steeple					

Severndroog Tower from Chiselhurst Steeple, 36778.

Names of Stations.	Observed angles. °	′	″	Distances.	Feet.
Severndroog Tower - -	100	42	0	New Cross -	23529
Chiselhurst Steeple -	42	22	0		34309
New Cross Station					
Severndroog Tower -	38	0	0	Eastcombe Point -	18014
New Cross - - -	49	55	0		14496
Eastcombe Point Station					
Severndroog Tower -	49	39	0	Woolwich - -	9628
Eastcombe Point - -	31	55	0		13879
Woolwich Steeple					
Severndroog Tower -	15	1	30	Bexley - -	23453
Crayford - -	57	48	20		7185
Bexley Steeple					
Well Hill - - -	61	48	0	Charlton - -	22835
Crayford - - -	36	39	0		33714
Charlton Farm					
Crayford - - -	23	17	10	Darent - -	20374
Charlton Farm - -	28	14	0		17026
Darent Steeple					
Ash Steeple - -	12	56	49	Dartford Brent -	33636
Crayford - - -	30	32	18		14830
Dartford Brent Mill					
Crayford - - -	16	16	18	Stone - -	21153
Stone Steeple - -	31	0	0		8069
Dartford Brent					
Ash - - -	15	42	50	Hartley - -	7869
Northfleet Steeple - -	4	56	20		24750
Hartley Steeple					
Northfleet - -	8	40	40	Ridley - -	35675
Ash - - -	101	42	0		5189
Ridley Steeple					

Names of Stations.	Observed angles.	Distances.	
	° ′ ″		Feet.
Gravesend - - -	38 36 50	Shorn Mill - -	14947
Halstow - - -	15 44 0		34435
Shorn Mill			
Sheppey - - -	39 22 14	Gillingham - -	48453*
Stockbury - - -	79 31 3		31257
Gillingham Steeple			
Sheppey - - -	63 7 52	St. James's Church -	20164
Gillingham - -	24 34 17		43257
St. James's Church, Isle of Grain			
Halstow - - -	73 41 28	Gillingham - -	23822
Sheppey - - -	28 9 15		48453*
Gillingham Steeple			
Gadshill - - -	23 35 24	Friendsbury -	11049
Sheppey - - -	4 10 33		60721
Friendsbury Steeple			
Halstow - - -	73 39 6	Star Inn - -	30617
Sheppey - - -	35 45 47		50270
Chimney of the Star Inn			
Halstow - - -	88 11 56	Bell Inn - -	47500
Sheppey - - -	44 45 13		67466
High Staff at the Upper Bell Inn			
Sheppey - - -	75 21 37	Hove - -	59215
Twinestead - -	50 40 20		4732
Hove Steeple			
Gadshill - - -	17 43 23	Upchurch - -	44466
Sheppey - - -	25 36 26		31395
Upchurch Spire			
Gadshill - - -	21 19 45	Bobbing - -	60739
Sheppey - - -	57 26 29		26212
Bobbing Spire			
Sheppey - -	46 5 47	Flagstaff - -	13063
Halstow - - -	13 7 45		41434
Flagstaff, Sheerness Garrison			
Sheppey - - -	17 13 51	Hucking - -	52765
Frinstead - - -	93 18 29		15656
Hucking Spire			

Names of Stations.	Observed Angles.	Distances.	
	° ′ ″		Feet.
Hernhill - - -	85 12 0	Sea Salter - -	17031
East Church - - -	22 15 10		43580
Sea Salter Steeple			
Tenham - - - - -	105 2 0	Whitstable - -	50935
Sheppey - - - -	48 28 58		65697
Whitstable Steeple			

SECTION FOURTH.

Determination of the Altitudes of the Stations above the Level of the Sea; and the mean Refractions deduced from observed Angles of elevation and depression.

ART. XLII. *Elevations and Depressions.*

At Trevose Head.

The ground at Cadon Barrow - - -	*elevated*	39′	24″
Bodmin Down - - - - -	*elev.*	10	48
St. Agnes - - - -	*depressed*	6	39
Hensbarrow - - - - -	*elev.*	29	2

At Bodmin Down.

The ground at Carraton Hill - - - -	*elev.*	27	49
Trevose Head - - - -	*depr.*	22	33
Cadon Barrow - - - -	*elev.*	16	0
Brown Willy - - - -	*elev.*	54	24

Cadon Barrow.

The ground at Trevose Head - - -	*depr.*	36	49
Brown Willy - - - -	*elev.*	36	3
The horizon of the sea in the direction of Trevose Head	*depr.*	30	56
Ditto in the direction north - - - -	*depr.*	31	12

St. Stephen's Down.

The ground at Black Down - - - -	*elev.*	25	21
Carraton Hill - - -	*elev.*	35	18
Brown Willy - - - -	*elev.*	42	9

Black Down, near Lydford.

The ground at	Maker Heights	*depr.*	32' 8"
	Carraton Hill	*depr.*	3 46
	St. Stephen's Down	*depr.*	35 18

Mendip Hills.

The ground at	Bradley Knoll	*depr.*	6 12
	Westbury Down	*depr.*	14 59
	Farley Down	*depr.*	18 21
	Lansdown	*depr.*	14 4
	Moor Lynch	*depr.*	34 53
	Dundry	*depr.*	15 45
	Dundon Beacon	*depr.*	38 24
	Ash Beacon	*depr.*	20 45

Dundry.

The ground at	Mendip	*elev.*	5 8
	Farley Down	*depr.*	10 1
	Lansdown	*depr.*	3 19

Lansdown.

The ground at	Dundry	*depr.*	5 44
	Mendip	*depr.*	1 39

Farley Down.

The ground at	Westbury	*depr.*	0 12
	Mendip	*elev.*	5 51
	Dundry	*depr.*	1 46

Bradley Knoll.

The ground at	Bull Barrow	*depr.*	8 59
	Ash Beacon	*depr.*	20 18
	Westbury	*depr.*	4 36

Westbury Down.

The ground at	Beacon Hill, Amesbury	*depr.*	10 9
	Bradley Knoll	*elev.*	7 1
	Mendip	*elev.*	1 28
	Farley Down	*depr.*	9 9

Dundon Beacon.

		°	′	″
The ground at Moor Lynch	*depr.*		6	8
Lugshorn Corner	*depr.*	3	56	13
Mendip	*elev.*		28	18
Pilsden	*elev.*		8	38

Moor Lynch.

The ground at Greylock's Foss-way	*depr.*	1	59	14
Lugshorn Corner	*depr.*		32	45
Dundon Beacon	*elev.*		0	9
Mendip	*elev.*		23	11
Pilsden	*elev.*		9	2
Ash Beacon	*elev.*		6	57

Greylock's Foss-way.

The ground at Moor Lynch	*elev.*	1	53	56
Dundon Beacon	*elev.*		34	48
Top of the staff (20 feet high) at Greylock's Foss-way	*elev.*		0	34

Lugshorn Corner.

The ground at Moor Lynch	*elev.*		27	21
Dundon Beacon	*elev.*	1	20	58
Top of the staff (20 feet high) at the west end of the base	*depr.*		1	9

Beacon Hill, Amesbury.

The ground at Westbury	*depr.*		4	36
Inkpin	*elev.*		6	22

Inkpin Hill.

The ground at White Horse Hill	*depr.*		10	54
Highclere	*depr.*		15	0
Beacon Hill, Amesbury			18	24

White Horse Hill.

The ground at Highclere	*depr.*		7	39
Nuffield	*depr.*		12	6
Shotover Hill	*depr.*		17	6

Scutchamfly Barrow.

The ground at Wendover	*depr.*	5'	36"
Whiteham Hill	*depr.*	11	20

At Shotover Hill.

The ground at Scutchamfly Barrow	*elev.*	0	20
Nuffield	*elev.*	1	27
Wendover	*elev.*	2	58
White Horse Hill	*elev.*	1	36

Brill on the Hill.

The ground at Nuffield	*depr.*	4	48
Wendover	*elev.*	3	55
Bow Brickhill	*depr.*	10	44
Epwell	*depr.*	6	57
Stow	*depr.*	7	6
White Horse Hill	*depr.*	5	45

Nuffield.

The ground at White Horse Hill	*depr.*	4	45
Top of the Staff at Brill on the Hill. Staff 13½ feet high	*depr.*	6	2
Bagshot	*depr.*	6	43
Highclere	*depr.*	4	12

N. B. The half stage belonging to the Royal Society was used at this station.

Wendover.

The ground at Brill on the Hill	*depr.*	14	59
Shotover Hill	*depr.*	17	21
Bow Brickhill	*depr.*	17	28
Stanmore	*depr.*	19	57

Stow on the Wold.

The ground at Shotover	*depr.*	13	48
White Horse Hill	*depr.*	7	30
Broadway Beacon	*elev.*	11	29
Brill on the Hill	*depr.*	14	45
Epwell	*depr.*	8	0

Broadway Beacon.

The ground at Stow	*depr.*	19	0
Epwell	*depr.*	17	25

Epwell.

The ground at Stow	*depr.*	3′	53″
Arbury Hill	*depr.*	6	39
Brill on the Hill	*depr.*	11	51
Corley	*depr.*	20	8
Broadway Beacon	*elev.*	8	31

Arbury Hill.

The ground at Epwell	*depr.*	14	25

Bow Brickhill.

The ground at Wendover	*elev.*	3	59
Kinsworth	*elev.*	5	35
Brill on the Hill	*depr.*	5	28

Kinsworth.

The ground at Brill on the Hill	*depr.*	12	37
Bow Brickhill	*depr.*	17	25
Arbury Hill	*depr.*	13	44
Stanmore	*depr.*	17	4
Lillyhoe	*depr.*	23	44

Bagshot Heath.

The ground at Nuffield	*elev.*	1	29
Stanmore	*depr.*	7	28

Stanmore.

The ground at Bagshot Heath	*depr.*	9	34

ART. XLIII. *Heights of the Stations.*

Stations.	Ground above low water mark. Feet.
Trevose Head	274
St. Agnes Beacon	621
Hensbarrow	1034
Bodmin Down	645
Black Down	1160
St. Stephen's Down	605
Bradley Knoll	973

Stations.	Ground above low water mark. Feet.
Mendip	999
Westbury Down	775
Dundry	790
Lansdown	813
Farley Down	700
Moor Lynch	330
Dundon Beacon	360
Lugshorn Corner	49
Greylock's Foss-way	42
Ash Beacon	655
Cadon Barrow	1011
Brown Willy	1368
Inkpin	1011
Nuffield	757
White Horse Hill	893
Shotover Hill	599
Muzzle Hill, (Brill station)	744
Whiteham Hill	576
Wendover, ground above	905
Bow Brickhill	683
Kinsworth	904
Lillyhoe	664
Stow on the Wold	883
Epwell Hill	836
Broadway Beacon	1086
Arbury Hill	804

ART. XLIV. *Mean Terrestrial Refractions.*

Between	Mean Refractions.
Bodmin Down and Cadon Barrow	$\frac{1}{5}$
Bradley Knoll and Westbury Down	$\frac{1}{6}$
Maker Heights and Black Down	$\frac{1}{6}$
Highclere and Inkpin	$\frac{1}{8}$
St. Agnes Beacon and Trevose Head	$\frac{1}{9}$
Moor Lynch and Lugshorn Corner	$\frac{1}{11}$
Hensbarrow and Trevose Head	$\frac{1}{12}$

Wingreen and Bradley Knoll - - -	$\frac{1}{13}$
Bodmin Down and Trevose Head - -	$\frac{1}{13}$
Carraton Hill and Black Down - - -	$\frac{1}{15}$
Westbury Down and Mendip - - -	$\frac{1}{13}$
Carraton Hill and St. Stephen's Down - -	$\frac{1}{15}$
Farley Down and Mendip - - -	$\frac{1}{16}$
Beacon Hill and Westbury Down - - -	$\frac{1}{16}$
Dundry and Farley Down - - - -	$\frac{1}{16}$
Dundon Beacon and Mendip - - -	$\frac{1}{17}$
Bradley Knoll and Mendip - - -	$\frac{1}{18}$
Lansdown and Mendip - - - -	$\frac{1}{19}$
Moor Lynch and Dundon Beacon - - -	$\frac{1}{20}$
Dundry and Mendip - - - -	$\frac{1}{20}$
Westbury Down and Farley Down - - -	$\frac{1}{21}$
St. Stephen's Down and Black Down - -	$\frac{1}{24}$
Moor Lynch and Dundon Beacon - - -	$\frac{1}{27}$
Dundon and Lugshorn Corner - - -	$\frac{1}{5}$
Moor Lynch and Greylock's Foss-way - -	$\frac{1}{6}$
Lugshorn Corner and Greylock's Foss-way - -	0
Cadon Barrow and horizon of the sea in the direction of Trevose Head - - - - -	$\frac{1}{13}$
Ditto in a northern direction - - -	$\frac{1}{12}$
Brill and Nuffield - - - - -	$\frac{1}{6}$
Broadway and Stow - - - -	$\frac{1}{10}$
Epwell and Broadway - - - -	$\frac{1}{11}$
Highclere and White Horse Hill - -	$\frac{1}{13}$
Nuffield and White Horse Hill - - -	$\frac{1}{12}$
Nuffield and Bagshot - - - -	$\frac{1}{17}$
Epwell and Stow - - - - -	$\frac{1}{17}$
Brill and Stow on the Wold - - -	$\frac{1}{19}$
Wendover and Bow Brickhill - - -	$\frac{1}{19}$
Kinsworth and Bow Brickhill - - -	$\frac{1}{18}$
Shotover and White Horse Hill - - -	$\frac{1}{18}$
Epwell and Brill - - - -	$\frac{1}{62}$
Bow Brickhill and Brill - - - -	$\frac{1}{32}$

Height of	deduced from	Feet.	Mean.
Black Down	Maker Heights	1169	1160
	Carraton Hill	1152	
St. Stephen's Down	Black Down	609	605
	Carraton Hill	600	
Westbury Down	Bradley Knoll	779	775
	Beacon Hill	771	
Farley Down	Mendip Hills	703	700
	Westbury Down	696	
Moor Lynch	Mendip Hills	335	330
	Ash Beacon	325	
Lugshorn Corner	Dundon Beacon	46	49
	Greylock's Foss-way	52	
Inkpin Beacon	Highclere	1014	1011
	Beacon Hill	1009	
Ash Beacon	Bull Barrow	653	655
	Bradley Knoll	657	

The above will sufficiently shew, what dependence is to be placed on the heights deduced from observed angles of elevation or depression; the results are, indeed, often less consistent, and frequently unsatisfactory; but, generally, they run on a parallel with these. The *data* from which all the heights have been computed, accompany this article.

The measurement of the base on Sedgemoor, shewed a fall of about 7 feet, from Lugshorn Corner to Greylock's Foss-way:

therefore, supposing that fall to be gradual and constant, all the way from the latter station to the surface of the sea at Bridgewater Bay, we shall get 24 feet, for the height of Lugshorn Corner from the surface of the sea. The altitude of this station, deduced from that of Trevose Head, is 49 feet; and, subtracting 3 feet from it, (the height of the bank on which the instrument stood above the moor,) we get 46 feet for the height of the moor at Lugshorn Corner, above the level of the sea at Bridgewater Bay. But this height, *supposing the fall regular*, is proved to be 24 feet. There is, therefore, a difference of 22 feet, granting the whole of this to be an error on the side of the survey: but, as the general surface of the moor at Bridgewater Bay is several feet above the surface of the sea, we may take a moiety of 24 feet, for the error of the computed height of the station at Lugshorn Corner.

ART. XLVI. *Matters relating to Refraction.*

The refractions contained in this account, like those in our former Papers, tend to prove, that when rays of light pass horizontally, and considerably distant from the surface of the earth, they are less bent or refracted from their rectilinear courses, than theory and opinion have laid down as fact. It is very certain, however, that objection lies against particular conclusions drawn from such *data* as we possess; because the angles of elevation and depression of corresponding stations are observed *at different times*, and almost always, therefore, under different circumstances; but, with the experience and continual practice of thus obtaining means of computing these refractions, although we may not be able to determine the refracting power of the air under given circumstances, yet, as the causes which render it variable, are as likely to predominate when the angles of depression or elevation are observed from low stations as when observed from high ones, we may be enabled to make some general deductions.*

When the instrument formerly made use of by General Roy was intrusted to my care, I possessed the means of determining, in a more accurate manner than had yet been done, the refractive power of the air near the horizon. To devote much time to it, has not, as yet, been in my power; because a more rapid extension of the survey was an object of greater importance. I did not, however, lose any opportunity which the subsequent season offered; the first was, when the instruments were at White Horse Hill and Whiteham Hill; the second, when one was stationed at Brill and the other at Arbury Hill; and the third opportunity offered itself, when one party was stationed at the latter place and the other at Wendover.

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* As many instances of strong atmospherical refraction have been related, and ingeniously accounted for, in some of the late publications of the Royal Society, I think it right to mention, by way of note, a very extraordinary instance of its variability.

In the month of June, 1795, when the instrument and party were stationed at Pilsden Hill, in Dorsetshire, on a particular day, at about the hour of four, I employed myself in observing the angles of depression or elevation of the surrounding hills. After I had done all that was necessary in this matter, I turned the telescope to *Glastonbury Tor*, and observed the depression of it. The air was so unusually clear, that, desirous of proving to a gentleman then with me in the observatory tent, the excellence of the telescope, I desired him to apply his eye to it: this he did, and, agreeably to a desire he expressed, I again took the depression of the upper part of the old building, which I was enabled to do with great accuracy, and found it 2" different; the first being 30',0", and the last 30',2". The unusual distinctness of this object, led me to keep my eye a long time at the telescope; and, whilst my attention was engaged, I perceived the top of the building *gradually rise* above the micrometer wire, and so continue to do, till it was elevated 10',45" above its first apparent situation; it then remained stationary, and as night drew on, the object became indistinct. The following evening, I observed the depression again, and found it 29',50". To what cause this extraordinary change in the refraction could be owing, I am at a loss to conjecture. The former part of the day had been warm, with little wind, and cloudy. The thermometer, at the time of observation, was 65°, and continued stationary for a considerable time. The sky was cloudy, but yet, as I have before observed, the air was remarkably clear. The top of Glastonbury Tor, I suppose, is about 200 feet from the surface of Sedgemoor, over a considerable tract of which, the line joining Pilsden with that object passes. The gentleman of whom I speak, as being with me in the tent, was Captain Darcy, of the Royal Engineers, who, no doubt, well remembers the circumstance.

On these occasions, the instructions which I communicated to Mr. Woolcot, and by which I governed myself, were to observe the elevation or depression of the corresponding station at the expiration of every hour, beginning at six A. M. and to have the watch well regulated from observed altitudes of the sun's limb. I requested him also to be very minute in entering on his book the state of the weather; to keep the instrument properly sheltered from the wind; to be always cautious to adjust his level; and also to insert the state of the air, as to temperature and density, by noting the thermometer and barometer.

During the time we were at the two first stations, White Horse and Whiteham Hills, there was only one day when the air was sufficiently clear for the purpose; this was the 6th of June. On that day, the following observations were made *at the same time as shewn by signal.*

Whiteham Hill. June 6th, 1799.

Hours.	Wh Horse H. Elevated.	Barometer.	Thermometer.	Remarks.
	′ ″	In. pts.	Degrees.	
3	6 4	29,730	60,3	Light airs at SW. Sun not shining; remarkably clear.
4	6 24	29,724	62,5	Ditto. Ditto ditto.
5	6 14	29,728	58,7	Ditto. Ditto ditto.
6	6 10	29,732	58,5	Ditto. Ditto ditto.
7	6 11	29,728	57,5	Ditto. Ditto ditto.
8	6 21	29,732	57	Very calm, and cloudy, but clear.
• 9	5 37	29,736	55,7	Ditto. Lamp at Shotover very bright. Dew falling.
•10	5 39	29,740	55,5	Ditto. Ditto.

To determine the refractions on the first arc, White Horse and Whiteham Hills, we have the distance between those stations = 88662,2 feet, which subtends an arc of 14′ 32″ nearly.

To determine those on the second, we have the distance between Brill and Arbury Hill = 146530 feet, subtending an arc of 24′ 8″,9: those on the third, Wendover and Arbury Hill, 210628 feet = 34′ 35″; and, for finding the refractions from the two last tables, we have the distance from Broadway Beacon to Epwell = 80611,4 feet, which subtends an arc of 13′ 11″ nearly.

The depressions and elevations were all taken to the ground, excepting those which are marked with asterisks. At White Horse Hill and Whiteham Hill, lamps were used at the hours of 9 and 10: they were also made use of at Arbury Hill and Brill at 9 o'clock. In the first instances, the lamps were placed (the centres of them) 1½ feet from the bottoms of the respective instruments; and in the last 2½ feet.

The height of the transit telescope above the ground was always 5½ feet; therefore, an allowance must be made, at each station, for the angle which that space subtends at its corresponding one; this premised, the refraction will be found from one of the two following rules, *viz.* if A be the contained arc, and D d the observed depressions, the quantity answering to the refraction, R, will be expressed by $\frac{A-D-d}{2}$; or, if one of the angles should be an elevation, e, then $R = \frac{A+e-d}{2}$: these rules give the refractions in the following table.

Refractions found from the preceding Angles of Elevation and Depression.

1. Arc. White Horse Hill & Whiteham Hill.				2. Arc. Brill and Arbury Hill.				3. Arc. Arbury Hill and Wendover.				4. Arc. Broadway Beacon and Epwell.			
Hours.	Refraction. pts. cont. arc.	Barom.	Therm.	Hours.	Refraction. pts. cont. arc.	Barom.	Therm.	Hours.	Refraction. pts. cont. arc.	Barom.	Therm.	Hours.	Refraction. pts. cont. arc.	Barom.	Therm.
		in. pts.	°			in. pts.	°			in. pts.	°			in. pts.	°
3 P. M.	$\frac{1}{10,8}$	29,5	58,0	9 A. M.	$\frac{1}{10,9}$	29,1	63,2	5	$\frac{1}{10,8}$	28,8	54,6	2	$\frac{1}{35,1}$	29,2	54,1
4	$\frac{1}{9,4}$	29,5	61,0	10	$\frac{1}{10,7}$	29,2	68,7	6	$\frac{1}{11,6}$	28,8	61,5	3	$\frac{1}{81,0}$	57,5	58,2
5	$\frac{1}{10,4}$	29,5	58,1	11	$\frac{1}{10,7}$	29,2	68,1					4	$\frac{1}{8,6}$	29,1	57,5
6	$\frac{1}{10,4}$	29,5	57,0	12	$\frac{1}{10,4}$	29,2	67,6								
7	$\frac{1}{10,6}$	29,5	57,0	3 P. M.	$\frac{1}{10,4}$	29,2	72,5								
8	$\frac{1}{9,5}$	29,6	55,6	4	$\frac{1}{7,4}$	29,2	72,0								
9	$\frac{1}{12,6}$	29,6	54,5	9	$\frac{1}{9,8}$	29,2	62,3								
10	$\frac{1}{14,0}$	29,5	54,3												

On examining the refractions obtained on the first arc, we perceive them to have been tolerably regular from 3 o'clock till 8; the mean being $\frac{1}{10,1}$ part of the contained arc. The height of Whiteham Hill is 576 feet, and that of White Horse Hill 893 feet, above the level of the sea: the ray passes, therefore, through a tract of air considerably elevated, as the country between the stations is, for the most part, flat and low.

The air is not often clear enough, or sufficiently free from tremulous motions, for these delicate observations. On the present occasion, however, the state of it was highly fit for the purpose; and, as care was taken, I am of opinion an error of more than 3″, taking that of the arch of altitude into the account, cannot have obtained in any of the angles. The refractions at 9 and 10 o'clock are less than at the preceding hours; but this does not appear to have been owing to any change in the refractive power of the air throughout the whole extent of the ray, because the depression of Whiteham Hill, from the other station, varied little at those hours. These changes in the observed angles of elevation at Whiteham, (44″ and 42″ being the differences,) *without* corresponding ones at White Horse Hill, prove that some *partial* alteration, from floating strata, had taken place in the refraction near the former station. Whoever considers the matter, must perceive a case may be constructed in which this will take place, causing a great variation in one of the angles, whilst the other *apparently* remains the same: and this suggested the idea, that to afford any accurate conclusions in this way, a long series of observations would be necessary. It furthermore appears, that dew could not have caused these differences at Whiteham Hill, since the same cause would equally operate to vary the observed angles at White Horse Hill; but those remained nearly the same.

The refractions on the second and third arcs, I consider as most accurate, on account of the great distance between the stations; and also as more to be depended on, from the circumstance of the ray generally passing 300 feet above the ground.

The fourth arc affords another instance of the refraction varying at one station, and remaining constant at the other. This, no doubt, was owing to the intervention of some partial stratum of air, nearer to Epwell than Broadway Beacon. The refractions, deduced from these contemporary observations are certainly inconclusive. The mean refractions, (neglecting the fourth arc) brought under one point of view, will be as follows.

Arcs.	Mean height of ray above the sea.	Refraction. Propl. pt.	Barom.	Therm.
	Feet.		in. pts.	
1. White Horse Hill and Whiteham	734	$\frac{1}{10,0}$	29,5	57,8
2. Arbury H. and Brill, 5 first refracs.	774	$\frac{1}{10,0}$	29,2	67,8
3. Arbury Hill and Wendover -	854	$\frac{1}{11,2}$	28,8	58,1

If the air had been in a quiescent state, previous to and also at the times when these observations were made, it might be expected that the differences of altitudes in the stations would be obtained, tolerably near the truth, *barometrically*. The remarks in the tables appertaining to the first and second arcs, shew that such opportunities offered; but those which belong to the third, prove the wind to have been fresh; and, as the space between the stations which constitute the extremities of that arc is 34 miles, nearly, it is not to be expected that a true result should be obtained. The differences of altitudes of the stations constituting the extremities of the two first arcs, obtained by means of the observed angles of elevation and depression, as well as from the heights of the mercury in the barometer, will be as follows.

Arcs.	Obs. Ang.	Barom.	Diff.
1	317	282	35
2	60	15	45

The little done on this subject, points out the necessity of doing more; it therefore remains with me to observe, that I shall lose no opportunity of employing the apparatus committed to my charge in the best and most diligent manner, both as relating to matters of refraction, and to all others connected with the Trigonometrical Survey.

In the Introduction, page 2, it is stated that this Account would be comprized in three Sections, but it was afterwards thought more convenient to divide it into four.

In Page 45, line penult. *dele* and Prittlewell.
—— 127, —— 14, *for* 1792, *read* 1772.

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AN

ACCOUNT OF THE MEASUREMENT

OF AN

ARC OF THE MERIDIAN,

EXTENDING FROM

DUNNOSE IN THE ISLE OF WIGHT, TO CLIFTON
IN YORKSHIRE,

IN COURSE OF THE OPERATIONS CARRIED ON FOR

THE TRIGONOMETRICAL SURVEY OF ENGLAND,

IN THE YEARS 1800, 1801, AND 1802.

BY MAJOR WILLIAM MUDGE,

OF THE ROYAL ARTILLERY, F. R. S.

INTENDED AS A SECOND PART TO VOLUME II.

ILLUSTRATED WITH EIGHT COPPER-PLATES.

FROM THE

PHILOSOPHICAL TRANSACTIONS.

LONDON:

PRINTED BY W. BULMER AND CO. CLEVELAND-ROW, ST. JAMES'S,
FOR W. FADEN, GEOGRAPHER TO HIS MAJESTY,
AND TO HIS ROYAL HIGHNESS THE PRINCE OF WALES,
CHARING CROSS.
1804.

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In page 19, line 13, *for* G, *read g*.
——— 35, lines 5 and 6 from the bottom, *for* 430 revolutions, *read* 436.
——— 88, line 3, *for* 45 divisions, *read* 4,5.
——— 112, line 28, *for* 133758 feet, *read* 802548.
——— Ib. line 29, *for* 830196 feet, *read* 161406.

AN

ACCOUNT OF THE MEASUREMENT

OF AN

ARC OF THE MERIDIAN.

B

AN ACCOUNT, &c.

Read before the ROYAL SOCIETY, *June* 23, 1803.

SECTION FIRST.

In the last account presented to the Royal Society, I expressed my intentions of making the operations which were to follow that period, subservient to the purpose of measuring a portion of the meridional arc, running from Dunnose, in the Isle of Wight, into the northern part of Yorkshire. In the account referred to, (See Phil. Trans. for 1800, page 565,) I stated my reasons for adopting that resolution, and my hopes that Mr. Ramsden would shortly finish the zenith sector which his Grace the Duke of Richmond had bespoken of him, when Master General of the Ordnance. As that celebrated artist, from the beginning of the year 1800 till the middle of the following summer, had proceeded with little interruption, except from illness, towards its completion, the whole was brought so near to a conclusion before he died, that Mr. Berge found no difficulty in rendering it sufficiently perfect.

It is proper I should state, more fully than I have formerly done, my reasons for selecting Dunnose as one of the extremities of my meridional line, and also those for preferring its meridian to any other; which I shall do as briefly as possible.

In a country whose surface, throughout its whole extent, is equally diversified with hilly ground, that particular part of it should be chosen, for carrying on a meridional measurement, which comprehends the most extensive arc. This arises from the necessary consequence which attends an operation in a country so circumstanced; as, possibly, no spot fixed on for a place of observation, could be supposed free from the effects of the unequal attraction in the adjoining matter. In such a country, therefore, a measurement upon the most extensive arc, must give the most accurate conclusion; for the errors arising from the cause here mentioned, like those of observation, lessen in their effects, on their application to arcs of increasing magnitude.

If Great Britain were a country thus diversified, the most eligible part would be that where the meridian from Lyme, in Dorsetshire, passes northward into Scotland. The difference of latitude between that place and Aberdeen, near to which that line cuts its parallel, is 4° 47′, nearly. But, however great the advantages attending such a length of arc might be, under the general circumstances of accurate terrestrial measurement, and accurate observations at its extremities, no beneficial consequences could be expected to attend the placing of the sector at intermediate stations; as the arc would be found running, almost every where, through a country abounding with hills, considerable both in magnitude and number.

Under this consideration, I determined to measure a portion of the meridian which proceeds from Dunnose to the mouth of the Tees; because, from inquiry, I had reason to suppose it the longest meridional arc in Britain, free from any apparent obstruction. And I was led to select Dunnose for one of its extremities, as observations made there, in conjunction with others at Greenwich, would enable me to make corrections of the latitudes of places given in our former papers, if found necessary. By fixing on Dunnose, I had also the means of ascertaining the distance of the Royal Observatory from the northern or southern end of my line, and, consequently, of connecting it with the parallels of Dunkirk and Paris.

Dunnose being fixed on, my subsequent endeavours were directed towards carrying on the triangles, as nearly as I possibly could, in the direction of its meridian, selecting the stations so that their sides might be properly inclined to it, and of sufficient length. In choosing the station at the northern extremity, I was careful to select it as near the meridian of the southern one as possible, and likewise in the neighbourhood of some open spot of ground, proper for the measurement of a base of verification. A station having these advantages, was found near Clifton, a small village in the vicinity of Doncaster; and a level of sufficient extent for a base, on Misterton Carr, in the northern part of Lincolnshire.

In the composition of this account, I wish to confine myself to that part of my operations which relates merely to the matter expressed under its title. I am possessed of materials sufficient for another Paper; and shall give about thirteen hundred triangles, principal and secondary, when next I present an account of the Survey to the Society: professing this, I shall now say, that in 1800 and 1801, the angles of the triangles constituting the meridional series were observed; and that, in the latter year, the new base was measured on the abovementioned

Carr. I should not omit mentioning in this article, that while the instrument was at Clifton, the direction of the meridian was obtained from numerous observations on the pole star, at the times of its greatest eastern and western elongations from the meridian. It will be recollected, that similar observations were made at the station on Dunnose, in 1793; (see Phil. Trans. for 1795, page 460;) so that nothing relating to the terrestrial part of the operation remained to be performed at the expiration of 1801.

On my arrival in town, after the measurement of the base of verification in the north, I had the happiness of finding the zenith sector nearly completed. Little remained to be done, besides the dividing of its arch; an operation which Mr. BERGE proposed to defer till the following spring: it was then divided, and the instrument, being otherwise complete, was delivered into my hands in April. An observatory of convenient form having been previously made, the sector was immediately erected in the Tower; and, from thence, with the permission of Dr. MASKELYNE, it was sent to the Royal Observatory at Greenwich.

It is now necessary I should enter into a minute detail of this instrument's construction, giving a description of its several parts, with references to proper drawings. If, indeed, I had no other motives, I should perhaps be induced to do it from justice to the merit and memory of the ingenious inventor; who seems to have exerted his talents to the full extent of the hopes he entertained, of rendering this instrument the first of its kind.

General Description of the Zenith Sector.

In the sector I am going to describe, Mr. RAMSDEN has obviated the inconveniences attendant on the use of former sectors;

and has also diminished, in a very considerable degree, the errors unavoidably resulting from their imperfect construction. The principles on which he has founded the several improvements, consist in the means of uniting the sectorial tube to its axis, so as to ensure the permanency of the length of its radius, when erected for observation; more accurate methods of adjusting the instrument vertically; and an easy way of placing the face of its arch in the plane of the meridian. Another circumstance of moment was, some contrivance by which the plumb-line should be brought precisely over the point, marking the centre of the circle of which the divided arch of the sector should be a part. The last desideratum, the ingenious artist procured, by applying the same contrivance which so eminently displayed his skill, in the construction of the quadrant belonging to his Grace the Duke of MARLBOROUGH; a contrivance by which the plumb-line can be as readily adjusted over the required point, by a person standing on the ground, as any adjustment, or other act within his reach, can be performed. A description of this, as well as of the means by which the instrument is rendered vertical, and otherwise correctly prepared for observation, will be given, with the assistance of plates.

Plate IX. Exhibits a general view of the sector erected for observation: it consists of two parts; 1st, the frame which supports the apparatus to which the sectorial tube is attached; 2d, the work constituting that apparatus, with the tube itself.

The external frame or stand is made of mahogany, and unites strength with simplicity of construction. In shape, it is an obtruncated pyramid, whose base is a square of six feet in length, and whose vertex is half of it. This frame, although light in its make, is yet, when united by means of square-headed screws, sufficiently firm. Inside this hollow stand is erected another frame, of the same substance, strong and well made, within which is suspended the sector; its frame being supported at top in every lateral direction, and sustained at bottom by a cone resting in a metallic concavity, the figure of which may be imagined, by supposing an arch of a circle to revolve round a tangent to one of its extremities. A cylinder, in the upper part of the interior stand, finds its place in an opening of an octagonal shape in the exterior frame, and, by a simple contrivance, is retained in that situation, while the sector and apparatus revolves on the cone. Thus, a ready means presents itself of turning the instrument round, with the face of its divided arch towards the east or west. It may be steadily retained in any position, by clamping it to the brass work of an azimuth circle, attached to the bottom of the external frame.

The direction of the meridian, at the place of observation, having been previously obtained from double azimuths of the pole star, this instrument admits of being placed in that direction very accurately. A telescope, twenty-nine inches in length, is attached to the side of the great tube, or rather, may be occasionally placed on a frame permanently fastened to it, having its axis in the plane of the divided arch, and very nearly at right angles to its radius. On the divided azimuth circle below, the angular bearing of any proper object may be set off, by turning the sector round till that object bisects the cross wires in the little telescope, and then noting the vernier. If the axis of the sector be horizontal, and the interior frame set perfectly upright, the instrument may be turned round from one point of the compass to the other, and properly adjusted for observation, in a few minutes.

In this general description, I am now to speak of one of the most ingenious contrivances attending the sector, which is, the means of readily adjusting the plumb-line in its several positions. I refer to the Plates and their descriptions, for a full account of it; but, as it will enable the reader to understand that which represents the instrument in its perspective view, (Plate IX.) I shall shortly describe this part.

The telescope of the sector is nearly eight feet long, and has an object-glass of four inches in diameter. It is attached to an axis, similar in shape to that of a transit-instrument, having at one end a lens, and near to the tube an arrangement of brass work, carrying a thin and diaphanous slice of mother-of-pearl, having, as appears to the naked eye, a dot upon it. The centre of this dot is by construction the true centre of the conical axis, and consequently of the circle of which the divided limb is a part. It is unnecessary to say, in this place, how that diaphragm was so adjusted as to have the centre of its dot where it should be, or the means by which it has been permanently fixed; it suffices that I say the point was placed most accurately, and the diaphragm fastened so firmly in the cone, that no readjustment of this part has been found necessary, since the sector came into my hands.

As the axis is hollow, a light, as that of a candle, held at its open end, is transmitted through the mother-of-pearl, which, stopping a part of its rays, exhibits a circle of red light to an eye looking through the lens at the opposite end of the axis; a well defined and exceedingly small dot appearing in the middle of the illuminated circle. Through proper openings in the upper and under parts of the axis, and suspended from a point not connected with it, passes the plumb-line, having its position by construction *close to the dot;* so that, by looking through the axis in this way, the plumb-line appears like a small black line on the face of the mother-of-pearl.

Now it is evident that, to an eye thus placed, when the instrument is adjusted for observation, the plumb-line should appear as if accurately bisecting the dot. To give, therefore, the observer the means of moving it to the right or left, when standing on the ground, (avoiding thereby the inconvenient necessity of elevating himself on steps as high as the axis,) Mr. Ramsden placed a microscope, about 5 feet in length, parallel to the telescope, on the outside of the interior mahogany frame. This microscope, bent as it were at right angles at both ends, has one of them open, and placed close to the pivot of the axis carrying the small lens. In the upper part of the microscope, and just under its roof, is placed a speculum, inclined, at an angle of 45°, to the line passing through the centre of the sector's axis, and close to its end. This reflector receives the converged images of the dot and wire on the illuminated spectrum, and transmits them down the tube of the long microscope: the rays, falling on a *plano-convex* glass, at no great distance from the bottom, are finally sent out to the eye by a prismatic glass at the end of the tube. Thus viewed, that which to the naked eye above appeared a small dot on the illuminated lamina, when magnified, as delivered below, is seen to be a small and well defined circle with a luminous area, admitting of the most accurate means of deciding on the right position of the plumb-line, by exhibiting small portions of light between it and the periphery of the little circle.

The mode of illuminating the hollow axis is likewise ingenious. On the side of the interior mahogany frame, and opposite to the vertical microscope, is suspended a lamp on two arches. At the back of it is a hollow cylindrical recess, in which is placed a polished metallic segment of a sphere. This concave reflector is attached to the cylinder, by means which give it any position required; so that the image of the burning wick, in the hollow of the lamp, may be thrown at pleasure on any spot above.

From the end of the conical axis, on the same side with this lamp, projects a small brass arm, carrying at its extremity a speculum, whose surface is placed at 45° with the vertical, and directly opposite the open end of the sector's axis. When the image of the burning wick is thrown from the concave reflector on the flat one above, the light passes through the hollow axis, illuminating the mother-of-pearl, and is, at last, sent down the microscopic tube to the eye below. This contrivance, collectively taken, is *unique*, and is full as accurate in its operation as ingenious in itself. From its nature, granting perfection of work, there can be no parallax between the dot and the wire. The images of the illuminated circle and wire, (plumb-line,) are coincident on the upper surface of the prismatic eye-glass, and transmitted so. In short, the whole has been so well managed, that the plumb-line can be made to bisect the dot or little circle, as accurately as the points on the divided limb of the sector. I consider this general description of this part of the instrument sufficient for the present; the proper plate, and its appropriate explanation, will supply what yet remains to be said.

The plumb-line is suspended above the upper part of the axis, from a point connected with the extremity of a bent lever, moveable round its fulcrum. The other end of the lever is acted on by a helical spring, which presses downwards, and causes it to bear against a screw passing through a head of metal beneath that end. The extremity of the long screw is square, and has its place in a pipe attached to a mahogany rod, divided in the middle by a universal joint. One extremity of this rod is brought down, and received in a socket within convenient reach of the observer, who, looking at the image of the dot and wire, turns the rod, thus connected with the bent lever, and thereby gives motion to the plumb-line.

The pivots of the sector's axis are of bell metal, ground perfectly true and smooth. They rest in Ys, firmly attached to the upper part of the frame. The method of uniting the plates carrying those Ys, is as follows: at the upper part of the mahogany frame are four hollow strong cylinders of brass, which pass through the wooden work, and, at the same time, serve to connect very firmly the two sides of the upper part of the frame. These cylinders project about six inches beyond the surface of the wood, and have screws and nuts at their ends.

The brass plates furnished with the Ys, have four holes in each of them, which answer to the ends of the screws, and are attached to the cylinders furnished with those screws, by the respective nuts. In the Ys, the pivots of the axis are placed; and, as a means of adjusting each Y is fixed to each plate, any position, within a certain limit, may be assigned to the sector and its axis.

To prevent the pivots of the axis from moving to and fro in a sidelong direction, Mr. Ramsden adopted a contrivance for keeping them, at all times, in the same constant position in the Ys. This *desideratum* was not to be dispensed with; for, if the ends of the axis, from the thickening of the oil, or the accumulation of dust, should work laterally in their angles, the distance between the plumb-line and arch would be continually varying; a perplexing evil, and the cause of great inaccuracy. The sum of this contrivance consists, first, in one of the Y plates having a small piece of brass screwed flat upon it, with a roller or friction-wheel at its end, which reaches just high enough to meet the vertical surface of the pivot a small distance within its circumference; and, secondly, in the other Y plate having a small apparatus, consisting of a lever furnished with another friction wheel and a spring, at its other extremity. This last mentioned roller, from the spring's action, presses against its proper pivot, and thrusts the other against the fixed wheel. By these simple but ingenious means, the axis is always retained in its proper situation with respect to the Ys.

To prevent the axis from bending, by the preponderance of the telescope and arches, Mr. Ramsden added braces and counterpoising weights. The braces are four in number, each being a hollow tube: they are fastened both to the axis and the telescope. Their principal uses consist in obviating the possibility of the telescope bending from accidental pressure, or vibrating when lightly touched. The method of preventing the telescope from sinking, or, in other words, the axis from bending, is by the use of levers and the abovementioned weights. These levers, two in number, are attached to the interior mahogany frame at top, the fulcrum of each being immoveable. At the end of each lever farthest from the tube, a weight is suspended, from a hook capable of being placed nearer to, or farther from, the fulcrum, at pleasure; thereby affording the means of raising the other end of the lever up against the cone, with any required degree of force. That extremity of the lever, so pressing upwards, has two large friction-wheels, which apply themselves to the sides of the conical axis, but do not retard the free motion of it, when the telescope is moved in the direction of the plane of its arch. These wheels, two on each lever, support the axis near the junction of the telescopic tube; and, as a few ounces only are by these means suffered to press on the pivots, no bending takes place in the cones.

From the middle of the two uppermost horizontal cylinders, which unite the sides of the interior frame at top, and which receive, with the two beneath them, the respective Y plates, arises a small but substantial apparatus of metal, embracing a hollow brass cylinder, of five inches in diameter, and about three deep, which passes up into an opening in the upper part of the external mahogany frame. This cylinder, with its corresponding stand, are sustained, without any sort of shake, by a helical spring. This mode, with that of supporting the azimuth circle below, are so well managed, that when the instrument is properly adjusted for observation, the axis of the sector continues perfectly horizontal, in every position of the frame.

There is likewise a very convenient method of sustaining the sectorial tube in any required position for observation. Across the interior frame, about the height of the graduated arch, run two long brass axles, with two wheels on each, one precisely in the middle of the axle, (and consequently in the same plane with the line vertically cutting the middle of the telescope,) and the other close to the pinion at the end of the axle. From a steel pin, something peculiar in its construction, situated near the end of the telescope, proceeds a string, which is wound eight or ten turns round the pulley. Attached to the inside of the interior frame, and just above the wheels nearest to the end of the axle, is another pulley, over which, passing into a long and narrow wooden compartment, is thrown a string, having a hook and a proper apparatus for receiving the moveable weights. The other end of this string is fastened to the pulley close to the axle, and gives motion to the telescope, or retains it in equilibrio, according to the arrangement of the two sets of weights, which consist of fifteen pieces of brass. By these means, all injurious pressure is taken off the point of the micrometer-screw, against which the telescope may be made to bear, with any required degree of force.

To cause the string passing over the middle of the pulley to draw in the exact direction of the limb's plane, Mr. RAMSDEN placed four small friction-wheels close to the eye end of the telescope, two on each side, and between each pair of wheels a steel pin, made like a T, with a hook at the end, to receive a string. This pin, where it applies to the wheels, is something in shape like a double cone, and is passed behind them. It always, from its construction, assumes the same position with regard to the friction-wheels; from which circumstance, the sustaining string is ever found in the plane passing through the centre of the telescope and the middle of the pulley.

The micrometer-screw, for measuring minutes and seconds, performs its operations in the usual way: it is moved backwards or forwards on a brass arch, parallel to the limb of the sector, and placed against the mahogany frame behind. To this arch the apparatus carrying the micrometer-screw is clamped; and it is adjusted, or brought parallel to the limb, by screws, so that the point of the micrometer-screw always bears exactly on the same part of the polished steel head, at the end of the sector.

The principal wires in the focus of the eye-glass are two, and are at right angles to each other. There are, indeed, two others parallel to the meridional one, and at equal distances from it; they were placed there with a view of rendering an adjustment of the horizontal wire sufficiently easy. These are illuminated by means of the lamp which carries the concave reflector before spoken of. There is a hole, with a lens, in the side of the telescope, directly opposite to the lamp, having behind it a diaphragm of brass, coated with plaister of Paris, and inclined to the vertical axis of the tube, at an angle of 45 degrees. The quantity of light, suited to the circumstances of the observation, is regulated by coloured glasses, placed over the hole in the side of the tube.

The plummet, suspended at the wire, falls into a cylindrical cup, swinging by two pins on its edge, on the extremity of a brass frame annexed to the interior stand; which frame is capable of being raised or lowered at pleasure by a milled-headed screw; so that the wire can, at any time, be released from the weight of the plummet, by screwing up the vessel containing it.

There are two arches attached to the end of the tube, one on each side of it, and firmly united together by means of brass pillars; which arrangement effectually secures the divided arch from injury. The total extent of the arch is about 15°, having half of its subtense on each side zero. It is divided into every 5 minutes; the micrometer-screw measuring any supplementary quantity. Golden pins were let into the arch, by the advice of the Astronomer Royal, on which the divisions were laid off by Mr. BERGE, in a very masterly and accurate manner, as will be seen hereafter. A magnifier, whose focal distance is about half an inch, is placed under the bottom of the cross piece opposite to the arch, and is furnished with a horizontal adjustment for bringing it directly over the plumb-line.

Among the various eye-pieces, of different magnifying powers, is one furnished with a prism. This, necessarily bent at right angles, enables the observer to see the stars without touching the frame. The use of it has been found convenient; but habit and proper caution enable the astronomer to use either of the other glasses. Having given this cursory and general description of the instrument, as seen at first view, I shall proceed to an explanation of the plates, which show its various parts.

Particular Description of the Zenith Sector.

Plate X. Represents a general section of the instrument and stand. AB is one of the four great uprights of the external mahogany frame, and CB its top, having an opening in D, for admission of light. The uprights consist of two strong pieces, firmly screwed together; each upright having seven strong screws, as seen in the upright AB. The top may be considered as a sort of square table, screwed down on the upper part of the frame. Between each of the two uprights is a brace, diagonally fixed, for strengthening the stand, as may be seen in the plate; and four others go horizontally, from upright to upright, for the purpose of still farther strengthening the whole. Across the bottom of the frame, and exactly in the middle of it, is a very strong mahogany plank, whereon rests the sector, having a stout straight edge bar of the same substance underneath. In the middle of this cross piece, as seen at E, is an apparatus of brass, furnished with an azimuth circle, having a hollow receptacle of bell-metal in the centre, in which rests, on a conical point, the interior mahogany frame FGHI. This brass work, which is strong and substantial, may be seen in Plate XIV. It is there represented *in plano*, with the bottom part of the interior stand

placed above it. The means of making the interior stand vertical, are found in the work annexed to the azimuth circle. They consist of two screws, attached to two plates of brass, placed at right angles to, and also flat on each other. S *s* (Plate XIV.), are the screws. A vernier on the divided circle may be seen at S; and at *s*, the method of clamping the bottom of the stand. On the opposite side is another provision for clamping this stand, when the face of the sector is changed from east to west, or *vice versâ*.

KLMNO*p* (Plate X.) is a section of the telescope and axis, MR, MR, being two of the four braces for strengthening the axis, and steadying the telescope. K is the place of the eye-tube; L the elliptical reflector for illuminating the wires at K; and ON a hollow cylinder of brass, independent of the tube. In the upper part of this cylinder, the object-glass is rivetted; the cylinder itself being fastened to the great eye-tube, in a permanent manner.

W, W, are two weights, hanging freely from the ends of two levers, the opposite ends being furnished with four friction-wheels. The points of support, between the weights and wheels, are at TT, being at the extremities of two upright solid pieces of metal, which are moved up or down by the screws beneath them. These counterpoising weights prevent any bending of the axis, between the pivots and those parts to which they apply. The apparatus for carrying the levers, is attached to the inside mahogany frame by screws, as represented in the section. See also Plate XIII.

The plummet and plumb-line are seen at *aed;* the point of suspension being *a*, and the plummet *d;* the plumb-line passing close by the arch, whose section is *bc*, and also near to the dot or small circle *e*, described on the thin slice of mother-of-pearl, shown in the section of the axis at *e*.

A lamp is attached, or rather rests, on circular supports annexed to the side of the interior frame, and may be seen at XZ. At the back of the lamp, placed in a recess, is a concave reflector at Z; and, in the front of it, a tube running out to X, having a double convex glass at P, for throwing the light on L, which first passes through a double concave glass in the side of the telescope, and then, from the reflector L, is thrown down on the wires near K. The concave speculum Z, has two adjustments for converging the reflected light on the little elliptical speculum *b*. This last-mentioned speculum throws off the said light at *b*, which passes into the axis at G, illuminating the mother-of-pearl at *e*, and, finally, is transmitted out of the axis at *p*.

klmn, is a section of the long microscope, for conveying the image of the dot and wire, sent out of the axis at *p*, to the eye at *k*. This microscope is firmly attached to the side of the frame, by brass cylinders, *kk*, *ll*, *mm*, *n*, and has one plano-convex glass at *q*, a prismatic eye-glass at *u*, and a metallic reflector at the top, *o*. At the upper end of this long microscope, and directly behind the speculum, is a screw, by which the reflecting metal is brought into one of its requisite positions. The other adjustment of that metal is performed by two screws, which apply to the sides, and give it lateral motion. The plano-convex glass at *q*, is rivetted into the head of a long tube *uq*, which slides up the microscope. The upper part of the microscope at *o*, is placed exactly opposite the end of the axis, in a very firm way.

The rod for giving motion to the plumb-line, is *vwx*; *v* being the top of it, *w* the place of the universal joint, which separates the two parts of the rod, and *x* the bottom of the rod itself, to which part the hand is applied. In this section, the top *v* is not furnished with the pipe connecting it with the bent lever above; but the representation of it, together with the lever itself, and accompanying spring, will be understood by referring to the plate which contains a representation of those parts.

In Plate XII. is a section of the axis passing through the pivots, and one exhibiting the face of the several united planes constituting the diaphragm, which adjust, in every direction, the slice of mother-of-pearl. Above this latter, is a view of the lever which gives motion to the plumb-line, with the pipe, spring, &c.; these are represented as seen from an eye at one of the pivots; and, above the other section, is a view of the same apparatus, seen in a direction at right angles to the former one.

In the latter of the above-mentioned sections, *bab* is the diaphragm, having in the middle, as at *p*, a circular piece of mother-of-pearl, extremely thin, with a small dot in the centre. This brass work is annexed to the large end of a hollow conical piece of brass, which exactly fits the axis at its proper place. It is there screwed fast, and may be considered as of one piece with the axis. In the adjoining figure, *bfkl*, is a section of the cone, *p* being the place in the opening of the brass work which receives the mother-of-pearl. In the representation of the diaphragm, *a* and *b* are two screws, at right angles to each other, and respectively attached to flat pieces of metal which slide on each other. If *fb* represent the plumb-line, the direction of each screw is that of an angle of 45 degrees with it. By means of these adjusting screws, the dot or little circle at *p* was placed in its proper position, or in the centre of the circle *abb*; so that, on an adjustment of the plumb-line, in any one position of the instrument, the dot still remains accurately bisected, however the telescope be subsequently moved. Above *abb*, is a small frame-work of brass, from which the plumb-line depends: it is attached to two of the four horizontal tubes on which the Y frames are fastened. *cd* is the pipe fastened to the end of the rod; the end of this pipe has a screw, which passes through a nut, and acts against the end of the lever *d*, whose centre of motion is *g*, and whose other extremity is *f*, where there is a small piece of hard steel with a notch, for the reception of the plumb-line *fb*, suspended from *g*. Against the upper surface of the arm *gd*, a helical spring continually presses downwards; it is fastened above the end of the lever, at *e*; by which means, the arm *gd* is constantly pressed against the end of the pipe, obviating the possibility of any play or shake of the lever, round its centre *g*.

The same figure contains an elevation of the frame-work just described, as seen by an eye in the plane of the diaphragm produced. It is necessary that it should be closely inspected, for the purpose of obtaining an adequate idea of its construction. In this figure, *xv* is a small cylinder, with a screw and loose collar at the end *v*, for fastening the plumb-line, which goes over the notch *n*, and passes through a hole in the upper part of the axis at *f*, and out again at *b*, almost touching the mother-of-pearl at *p*. *sru* is a strong spring, fixed at *s*, through the middle of which, at *r*, passes a screw, which is, in fact, an adjusting screw, for bringing the plumb-line close to the dot on the surface of the diaphragm; and here it is necessary to observe, that the plane of the divided arch and that of this diaphragm, are one and the same when produced. There is no part of the instrument more complete than the apparatus for suspending the plumb-line, and that which regards the dot. I shall now return to a farther consideration of the construction of the axis.

In Plate XII. there is also a horizontal view of the upper part of the axis; A being the head of the microscope, and B the little diagonal speculum, for throwing the light on the diaphragm. C is the opening in the axis above the object-glass; and D a brass slider, for covering the opening at C. E and F are two pulleys, attached to the side of the axis, over which pass two strings, having their ends united in opposite points of the shutter D; the other two ends of the string being within reach of the observer, who by this means easily opens or shuts the slider.

In Plate XIV. ABCD is the moveable frame, fastened to the top of the external stand, and having an octagonal opening at E, for receiving the brass work connected with the four horizontal pipes carrying the Ys. The touching points between the octagon and cylinder, are *g*, *h*, *n*, at which parts of the frame hard pieces of metal are inserted. To prevent all possibility of shake in the cylinder, which would render an adjustment of the instrument troublesome, if not impossible, there are two strong screws at *m* and *n*. One is a helix, which acts against *m*, and against the end of the sliding piece *n*; so that, by a condensation of the helix by the screw *m*, the piece *n* acts against the head of the cylinder inserted in E.

Plate XI. represents an elevation of the instrument seen sideways, and is that part to which the long microscope is attached; it serves to show the formation of the interior stand carrying the sectorial tube. A B C D E F are mahogany uprights, firmly united at the bottom and sides by proper cross pieces, and at top by the plate of metal *a b c d*, through the ends of which pass those of four horizontal pipes, the plate *a b c d* being one which carries a Y, hidden in this elevation, by the upper part of the head of the microscope.

In the middle of the cross pieces, which unite the side of the frame to its corresponding one, are two wheels with long axles, as before mentioned. In this elevation they are seen at B and E; and have strings passing from them to their respective sides of the tube, where they attach to the pins P, P. At the ends of the axles nearest to this elevated side are two other pulleys. In the view which this plate affords, these wheels are projected against the others just spoken of; but their uses will be more readily understood, on perceiving the strings which pass over the upper pulleys, and afterwards sustain the weights W, W, in their upright cases.

In this elevation is seen the telescope attached to the side of the great tube: it is used when the instrument is got into the plane of the meridian. The vessel for receiving the plummet is seen at V; and at S the adjusting-screw, for elevating or depressing the frame which supports it. LL is the clamp-arch, supposed to be attached to the other side of the tube, or that which supports the lamp. At the bottom of the stand is seen the azimuth circle, and the apparatus belonging to it.

For the purpose of conveying a clear idea of the arrangement of the lower pulleys, and the manner in which the two arches are joined to each other at the end of the telescope, there is given, in Plate XII. a horizontal view of the same. The vessel for receiving the plummet, its supporting frame, and the magnifier for viewing the dots or points on the divided limb, are likewise represented. The body of the telescope is here taken away, leaving nothing more than the plate at its end, with the contiguous work belonging to the wires.

To show with distinctness and sufficient perspicuity, the manner in which the cross wires are sustained in the tube, also the means by which they are adjusted, figures are given in Plate XII. These also show the micrometer-screw, and the mode of clamping it to the proper arch. In the horizontal representation of the end of the telescope, the wires are seen in the centre, and also the two screws, with the helical spring for adjusting and retaining them. EF is a strong brass arch, with an edge bar IK, placed parallel to the divided arch. At EF are seen two milled-headed screws, passing through a metallic embracement of the bar and arch, which are firmly connected with the apparatus belonging to the micrometer by their means. At S is a piece of hard polished steel, against which the point of the micrometer-screw rests; and, as the arch EF is the segment of a circle whose radius is its distance from the axis of the sector, the point of that screw always buts against the steel head in the same place. In this plate is also seen a vertical section of the same parts. Here, EF is the back arch, and MS the micrometer-screw. This figure also shows the means by which the pieces carrying the wires, and inserted into the end of the telescope, are retained in their proper places. CA and DB are two long pillars, which pass through an annular piece of brass parallel to the end of the tube.

A screw with a windlas-like head is seen at G, from the turning of which, the wires are moved in one of their proper directions. A screw for giving them a motion at right angles to that obtained by the fore-mentioned one at G, is seen in the horizontal view of the end of the telescope at H.

It would be swelling this account to an inconvenient size, if I were to attempt any farther explanation of the plates; I shall, therefore, close this article with a few observations on the manner of adjusting the instrument for observation.

Manner of adjusting the Instrument for Observation.

The feet of the external stand should be first carefully brought into a horizontal plane; and, when they are so, the azimuth circle will be, necessarily, parallel to it, having its centre under the middle of the opening in the mahogany frame screwed on the top of the stand. This being done, and the instrument set up, the plane of the arch should be brought parallel to one of the sides of the stand, in which situation, the internal frame is to be clamped to the azimuth circle, and the wire brought to its proper distance from the limb, by means of the adjusting-screw attached to one of the sliders, which carries the concave receptacle and conical point. The dot at zero should then be brought exactly under the plumb-line, as seen through the magnifier, and the point on the micrometer-head, at which its index stands, noted. The instrument is then to be turned half round; and, if the same dot on the arch still continues bisected, it will afford a proof of the internal stand being upright in one direction. But, if the dot should not continue bisected by the plumb-line, it must be made to do so, and the revolutions, or parts of a revolution, counted; half of which is to be turned back on the micrometer-head. The same dot, zero, is then to be brought under the wire, (plumb-line,) by means of the other adjusting-screw beneath the azimuth circle. If the stand is pretty accurately set up, one operation is sufficient for bringing the interior frame upright in one direction, *viz.* either in that of the meridian, or the one at right angles to it. The arch is then to be turned round 90°, and the same operation gone through. This being properly done, the interior frame is made perfectly upright.

The next step to be taken, is that of placing the long level on its axis above, and rectifying that axis by means of the Y plate screws. If this be done carefully, the bubble will remain between the pointers of the level, whatever position the sector may be placed in. Having thus rectified the instrument, by making the internal frame upright, and the axis horizontal, the only remaining point to engage attention is, placing the plumb-line at a proper distance from the arch: this is done by means of the screw acting on the spring just under its point of suspension. If great care be used in going through these several adjustments, the instrument may, at any future time, be accurately adjusted for observation, by turning the proper screw belonging to the azimuth circle, and bringing the arch to its usual distance from the wire.

Laying off the Points, or dividing the Limb of the Sector.

The first step preparatory to finding the length of the radius, was to mount the sector in its frame, and adjust the counterpoising weights. By attention to the proper points on the levers, the axis was kept from bending, the pivots not having more than a weight of two pounds to support. This done, a tool with a well defined point was made to press lightly against the face of the arch, and firmly sustained in that situation, while the sectorial tube was slowly moved to the right and left: a fine line was by this means described on the limb, passing through the centres of the golden pins. The arch having been thus struck, the telescope was taken out of its frame, and laid on the edge of a very strong plank, having its axis horizontal, and the pivots resting in Ys firmly fastened in the middle. The end of the arch, whose face became vertical, was supported by a brass plate screwed down on the end of the plank. When the pivots were placed in the Ys, and the telescope sustained in several places, to keep it from bending, a brass slider, on the surface of the plank, was moved till the line before mentioned coincided with that described on the arch. The telescope was then quickly taken out of the Ys, and, as speedily as possible, brought into a similar position on the other side; for which purpose, braces to support the tube had been previously prepared. By these means, twice the length of the radius was obtained; proper care having been taken to have the Ys so placed, that the centre of the pivots should be in the same plane with the two sliders at the extremities of the plank. The distance between the lines was then measured, and $\frac{1}{16}$ taken for the chord of 7° 10′, which was immediately laid off on the face of the sector, on both sides zero.

Although little doubt could be entertained of the truth of the total arc thus assumed, yet, that the length of its chord might be compared with that derived from the usual modes of operation, Mr. Berge (as proposed by Mr. Ramsden) prepared a brass arch, which he let into a frame, on which, after striking a portion of a circle with the radius obtained as above, he laid off the chord of 60°. This arch he divided by continual bisection, till he obtained the chord of 7° 10′, which he compared with the same angle laid off on the sector's limb. He had the satisfaction of finding no perceivable difference; and, that there really existed none, was denoted by the unresisted fall of the points into their respective holes. The arch of the sector was then divided into degrees, and every degree into five minutes; and the holes were afterwards opened with a tool made for the purpose. As gold pins had been let into the arch, Mr. BERGE was enabled to go through the division of it with great success, and afterwards to enlarge the holes, without destroying his accurate work. The observations will offer a more satisfactory testimony of the credit due to his abilities as a workman, than any opinion which I might express myself as entertaining, although founded on the same *data*. It remains for me only to observe, that I think he has delivered this instrument into my hands without any imperfection of execution; and that I believe it would not have been superior, had the ingenious inventor lived to complete it.

Adjustment of the meridional and horizontal Wires.

After the arch was divided, the axis of the telescope was laid on a pair of Ys connected to a firm support, and made nearly horizontal. The tube was then brought up to a level with the axis, and sustained at proper intervals, whilst the end of the telescope rested on a small piece of metal connected to a fixed bar, by means of an adjusting-screw. This end was then moved, till an object sufficiently small, (a speck or dot,) at a proper distance, appeared nearly in the centre of the field. The telescope was then properly secured from bending, and rendered perfectly steady, but admitting of a small motion sideways, the Ys having also a corresponding adjustment.

A microscope, furnished with a moveable wire, was then fastened to a beam attached to the brick wall, and its end brought close to the edge of the arch of the telescope. Upon this edge, as well as on that of the other arch, Mr. BERGE had the address to lay off a point, very nearly in that place where the plane passing through the axis and zero cuts the arches. This being done, the telescope and Ys were moved laterally, till the vertical wire bisected the speck. The system of wires was then turned, till the meridional one was made exactly perpendicular to the axis, as seen from the mark being bisected in every part of the wire, when the end of the telescope was moved up and down by the adjusting-screw. The axis was then carefully taken out of the Ys, and inverted: it was afterwards placed as before, and the distance between the spot and vertical wire estimated by the eye. The telescope was then moved in azimuth, half that quantity, and the meridional wire brought to a bisection on the speck. Repeating this operation twice or thrice, the vertical wire became accurately perpendicular to the line passing through the centre of the conical axis, and also in the plane passing through the centre of the tube.

The next step was, to move the whole system of wires in the direction of the perpendicular, in order that the horizontal one (at right angles to the vertical wire by construction) should be also brought into its proper position. For this purpose, the telescope was moved a little in azimuth, and the proper wire made to bisect it accurately, at which time, the wire of the micrometer before mentioned was brought over the dot on the edge of the limb.

In this position of things, the instrument was taken off the Ys, and turned over; it was then again carefully placed in its former position, and the end of the telescope brought up by the adjusting-screw, till the distant speck was bisected by the horizontal wire. Now, if this horizontal wire had been, by accident, placed so that the point of intersection of the two wires was exactly in the true centre of the telescope, the dot on the edge of the other limb would have been bisected by the wire of the anterior microscope. This was found not to be the case; but it was made to be so, by halving the differences, and moving the horizontal wire so as to bisect the mark. After this had been again examined, the vertical wire was examined, when it was found necessary to go through a part of the operation a second time. This was to be expected; but the wires were, by these means, at last properly placed, and guards were then fixed over their adjusting-screws. I shall now proceed to speak of the use I made of this sector in the year 1802.

Particulars relating to the Operations of the Year 1802.

I have already stated, that a proper observatory had been provided for the reception of the zenith sector. The dimensions of it were twelve feet square at bottom, and six feet square at top; its proportions being the same as those of the external stand. A floor having a square vacuity, to admit of the instrument standing on the ground, covered the joists of it. The sides of the observatory were of strong painted canvas; and the roof of wood, with an aperture, which could be opened or closed at pleasure, for viewing the stars near the zenith.

The instrument, with this observatory, was erected in the Tower on the 3d of April, merely to examine all its parts, and to ascertain whether any thing could be done to render it more perfect. Some trifling *addenda* were accordingly made, and the whole, thus rendered perfect, was removed to the Royal Observatory, and erected in the garden of the Astronomer Royal, close to the eastern extremity of the transit room.

I am now to specify, that my intentions were to devote, from this period, the whole or the greatest part of the following summer, to the use of this sector; nor did I indeed imagine such a portion of time more than sufficient. I purposed to erect it at Dunnose, and at Clifton, the extremities of my arc; and also at Arbury Hill, near Daventry, the station almost in the middle of it. This last station I fixed upon, because it was proper to ascertain how far the observations for determining the extent of the whole arc, would agree with any others made for finding the value of its parts. The erecting of it at Greenwich was necessary, for the purpose of observing the zenith distances of certain stars, which were afterwards to be observed at Dunnose, thereby affording means of ascertaining the latitude of that station.

The instrument remained at the Royal Observatory till the 26th of April; and, although the weather was for most part of the time unfavourable, yet the erecting of it there will be found, as appears in a future part of this work, to have answered the proposed end. One very material service accrued to myself; this was, the advice and instruction I received from the Astronomer Royal, for the successful management of the sector, by which I scrupulously governed myself throughout the whole of the subsequent campaign. Having observed the zenith distances of some few stars, and made myself completely master of every adjustment about the instrument, the sector, with all its apparatus, was sent to the Isle of Wight, by way of Southampton; every possible care being used to protect it from injury, not only while transporting by land, but also when under the act of being taken into, and removed out of, the vessel which conveyed it from that place to Cowes. It will be readily supposed, that watchfulness and care were necessary, to preserve this complicated instrument from being damaged by accident or roughness of the roads.

In the year 1794, an iron cannon was sunk in the ground, for the purpose of permanently preserving the point on Dunnose, where the direction of the meridian was observed in 1793. It must be now remarked, that the cannon so inserted could not have its breech placed so low as might have been wished; in consequence of which, it became necessary to erect the observatory for the reception of the sector some little distance southward of the old station. The distance from the centre of the gun to the point over which the instrument was afterwards erected, was six feet and a half.

To procure for the external stand, and thence for the whole apparatus, a firm foundation, I caused four long stakes to be driven into the ground, one for each foot of the stand, to which its feet were firmly screwed down. The surfaces of the stakes were then cut off smooth, and brought into the same horizontal plane, by which means, the interior frame and sector were placed much within the limits of their several adjustments.

The pointed top of Sir RICHARD WORSLEY's obelisk afforded me an excellent means for bringing, with the assistance of the side telescope and azimuth circle, the plane of the arch into the true meridian. The distance and magnitude of that object is extremely convenient for the purpose. Its bearing from the meridian of the station is 87° 42′ 33″, as I shall show in its proper place. The side telescope was turned to this object very frequently; and I never found the vernier, on the azimuth circle, to indicate any serious warp in the stand. Its greatest variation was 4′; but, for several days together, it did not amount to 30″.

The weight of the plummet, I adjusted to the strength of the plumb-line, in the usual way. I suspended it in air, and gradually increased its weight, till the wire broke. This plummet was then immersed in the vessel appropriated for its reception. It will, perhaps, not be improper to observe, that I was careful to give the plummet its maximum of weight, that its wire might not be subject to motion from streams of air.

As it was to be apprehended that errors would result, from the effects of an inequality of temperature in the air within the observatory, I placed two thermometers, both adjusted to a third, near the telescope. One I elevated as high as the axis, the other I laid on the hollow brass cylinders which connect the divided arch with that behind it, usually called the back arch. In the day, I found (as may be seen in the register of observations) the heat a little greater at the top of the tent than towards the bottom; and the reverse was generally the case at night.

To equalize the temperature at those times when the sun shone out, or the weather was hot, I opened the shutters in the roof, as well as the door of the observatory, a considerable time before the moment of observation. By these means, the air within the tent was rendered tolerably uniform in its degrees of heat. For the space of a week following the commencement of my observations, I suspended a third thermometer from the milled-headed key which turns the diaphragm placed inside the telescope. As the situation of this thermometer was midway between the two others just mentioned, I always found the temperature there, a mean between those degrees shown by the upper and under thermometers; and as, in the course of the time specified, I had various opportunities of satisfying myself on this point, I desisted from making any farther use of it. For the purpose of ascertaining the limits of the errors likely to result from the cause now spoken of, it will be right to institute some little inquiry into its mode of operation.

In Plate XVI. Fig. 1, let CD be the line passing through the centre of the sectorial tube, brought into any position for observation; the angle made with the zenith being ACB, and CA the consequent direction of the plumb-line. CB and BA may therefore represent the radius and arch of the sector, when in a state of uniform temperature throughout.

Now, at any time, let the thermometer at the top C, indicate a degree of heat superior to that shewn by the other at B; and let it also be supposed, that the difference between those degrees of heat, at any intermediate point, is directly as the distance of that point from C or B; and farther, let the tube CB be extended to D, while the arch AB continues of the same length.

If the line CA be extended to F, and the line AE be drawn parallel to BD, meeting the arch FD in E, then will the small space FE measure the error in the observed zenith distance of the star.

As the angle ACB must in all cases be small, ACB and EF may be considered as two similar sectors of circles; under which supposition, we get $FE = \frac{AB \cdot EA}{CB}$; and, applying this to an extreme case occurring at Arbury Hill, on the 12th of September, we get $AE = \frac{5^\circ \times 0{,}0001237 \text{ inches} \times CB}{2 \times 12}$, hence $FE = \frac{5^\circ . \times 0{,}0001237 \times 6^\circ . 26'}{2 \times 12}$ $= 0'' {,} 596$.

As few of the stars selected for observation were, at either of the stations, so far from the zenith as 6°, it is obvious little inaccuracy can have resulted from the difference of temperature here spoken of; and this supposition will receive farther support, from the actually near approach of the two temperatures to an equality with each other, as appears by taking the mean results of the last two columns in the register of observations. That the scrupulous mind may be satisfied in this particular, I shall insert, in its proper place, a table for supplying the correction arising from this cause; as the effect of a greater heat in the upper part of the tent is an error in excess, so a reverse of the case produces one in defect.

On the first convenient opportunity, I measured, with great care, the distances between every successive set of dots on the divided arch, contained between zero and 7° 10′. This was done at a time when the thermometers denoted a perfect uniformity in the temperature of the air within the tent, and when, from the calmness of the day, no streams of air could affect the plumb-line. Although I had, previously to the performance of this matter, perfectly satisfied myself that the rays of heat, emitted from the lamp illuminating the face of the arch, do not expand it perceivably, yet I thought it best to wait for a day when the strength of the light should enable me to discover, and properly bisect, the points, without the aid of that lamp: Between zero and 7° 10′, on the left hand arch, I found there were 430 revolutions of the micrometer-screw + 38,2 divisions; and, between the same point and 7° 10′ on the right hand, 430 revolutions + 39,2 divisions.

From this it appears, that the mean value of one revolution of the screw, is 0′ 59″,098. Mr. Berge endeavoured to place the arch, carrying the apparatus of the micrometer, so that one revolution of the screw should be exactly a minute. On trial, he found it nearly a second short; for which reason, he divided the head into 59 parts, and called each of them a second. I think it proper to repeat the observation, that the two arches were measured with the greatest care, because it admits of the remark, that every space subtending 5′ was measured with the *same part* of the screw, beginning very nearly from 9 on the index. This instrument will, at a future period, probably pass into other hands; it may therefore be right to state, that I found, from an examination of the screw, an error of nearly 1″, in the part contained between 17 and 19 on the index, arising from a small notch which, with a magnifier, I could plainly perceive on one of the threads. As it cannot but be the general wish to have some evidence of the accuracy with which this sector has been divided, and also how far I have succeeded in the performance of what is now under consideration, a table will be given, in which the value of every 5′, in the first degree on each side zero, will be found in revolutions and parts of the screw.

Having towards the end of June found my observations sufficiently numerous, and apparently sufficiently accurate, from the regular differences subsisting amongst them, I took down the sector, and, with every thing belonging to it, repaired to Clifton, the northern extremity of my arch. The instrument arrived there in safety, on the 20th of July; and, as the direction of the meridian had been previously determined, the instrument was immediately set up, and made ready for use.

At this station, Laughton spire afforded me an excellent mark for adjusting the instrument in the plane of the meridian. The bearing of it is 1° 56′ 12″ south-west; and, from my being able to see it in the observatory, without rolling up either of its canvas sides, I had ready means, at all times, of turning the telescope to that object. And I can take upon me to say, that during the whole of my stay at this station, I never found the instrument out of the plane of the meridian more than half a minute.

Of the 27 stars observed at Dunnose, 17 were observed at this station; they were the following, *viz.* β, γ, 45*d*, 46*c*, 51, 16, μ, Draconis; 1κ, 10ν, Cygni; η, ξ, Ursæ; 22τ, 85ν, 52, υ, Herculis; α Persei, and Capella.

As the weather for most part of the time proved favourable, the observations were completed on the 22d of July; and, as there appeared to be sufficient time, between that period and the arrival of the season which would necessarily terminate my operations, to carry on my meridional line to the Tees mouth, I reconnoitered the country in that quarter, and selected the stations all the way between it and Clifton.

On the 23d of July, the instrument and observatory were taken down, and the large theodolite erected over the point. White lights were sent to the distant stations, and were all observed, except those fired on the 30th day of the same month; and, as the night on which those lights were burnt was remarkably clear, and it was therefore probable that some intervening land obscured the distant hill, I desisted from making any farther attempt towards the execution of the above scheme, as any greater loss of time might prevent me from making the proposed observations on Arbury Hill. I therefore sent the sector to this last-mentioned place, where it arrived on the 3d of September, and was erected on the 7th, the direction of the meridian having been previously ascertained, by two double azimuths of the pole star. But it is proper I should observe, that the sector was not set up over the old station, as injury to some amount would have been sustained by the person farming the soil, owing to its cultivated state. The spot on which I fixed, was 34 feet to the north, and 28 towards the west, of the former station.

Of the stars seen at Clifton, 12 were observed at Arbury Hill. These observations were continued, with very little interruption, till the 4th of October, when the party, with all the apparatus, returned to London; the zenith sector being found as perfect on its return as when first sent into the field, a circumstance inferring both the strength and perfect union of its parts.

Particulars relating to the Measurement of a new Base Line, on Misterton Carr, in the Year 1801.

The apparatus used for the measurement of this base, was the same as that employed on Hounslow Heath, Salisbury Plain, and Sedgemoor; and the like pains were taken to ensure its accuracy, as were used on those occasions. The points for lining out the base were put into the ground with great truth and precision; the large theodolite being used as one of the means, and in the same way as in measuring the base on Salisbury plain. Previous to the commencement of this operation, two large blocks of oak, with square holes on their upper surfaces, were sunk in the ground, at the extremities of the base; the point of intersection of the diagonals of each hole, severally denoting them. These diagonals were drawn on lead, cast into the holes, and ground to a smooth plane, even with the surface of the block.

Before the measurement began, the working chain A, and the

50-feet chain, were both compared with the standard B. For this purpose, a calm cloudy day was waited for, which opportunity presented itself on the 2d of June. The pickets for the registered heads were then driven into the ground a considerable depth, and the coffers laid in a right line between them. The chain A was then laid out perfectly straight; and five thermometers, equally distant from each other, were put close to its side, their temperatures being as follows.

Thermometers.

1 — 2 — 3 — 4 — 5.
67°. 65° 67°,5 — 67°,5 — 67°,5.

The chain A was then taken out of the coffers, and B laid out in its stead. The difference of their lengths, which was measured with the micrometer-screw, was found to be 1 revolution 6 divisions, *viz.* A longer than B; the temperature remaining constant the whole time of trial. In the course of the day, the same operation was repeated, the five thermometers standing at 69°,5—69°—69°,5—69°—69°, when B was found to be 1 revolution 6½ divisions of the micrometer-head shorter than A. Therefore, the mean, *viz.* 1 revolution 6¼ divisions, was considered as the true difference of their lengths. The length of twice the 50-feet chain was, at this trial, found to exceed that of B, 2 revolutions 4,5 divisions; which is nearly the same determination as formerly resulted, from a comparison of the chains with each other on Sedgemoor. It may be seen too, by referring to the account of the measurement of the base on that spot, that the difference between the lengths of the standard B and common chain A, was nearly the same at that period as now; the difference being 1 revolution 7 divisions. I therefore concluded I might, with safety, suppose the length of the standard chain B to be exactly the same then, as at the period when Mr. Ramsden compared it with the points inserted into the cast iron bar, mentioned in the first account of the trigonometrical operations.

The measurement of this, the fourth base, commenced on the 6th of June; and was continued, without much interruption from bad weather or other causes, till the 28th of July, when it concluded with the 263d chain, the overplus, 38,321 feet, being carefully determined, by means of a silver wire and pointed plummet let fall over the point marking the north-west extremity of the base. The two chains were then carefully compared with each other; when it was found, that the wear of the chain A was exactly one division on the micrometer-head, or $\frac{1}{200}$ part of an inch. As the length of this base is nearly the same as that on Sedgemoor, it was reasonable to suppose that the elongation of the chain, by the working of the joints in each measurement, would be found the same, provided no injury had taken place from accidental circumstances, or rusting of the pivots and holes, during the time the chains were laid up in the Tower. After the reduction of the base, I shall have occasion to show that my ideas were correct in this point, as Mr. Berge has lately remeasured both chains.

Angles of the great Triangles observed in the Years 1800, 1801.

At Beacon Hill.

Between		°	′	″	Mean.
The north and south end of base	-	20	47	19 20 20,25	″ 19,7

Between	°	′	″	Mean.
North end of Base and Gringley -	34	44	40,75	″ 42,25
			42,25	
			42,75	
			43,25	
Gringley and south end of Base -	13	57	22,75	24
			24	
			24,25	
			25	
Heathersedge and Gringley -	138	9	15,5	16
			16	
			17,5	
At North End of Base.				
Beacon Hill and south end of Base -	60	17	16	16,5
			16,25	
			17,25	
Beacon Hill and Gringley -	74	46	55,5	56,5
			56,25	
			57,25	
			58	
At South End of Base.				
Beacon Hill and north end of Base -	98	55	26	27,5
			27	
			28	
			29	
Beacon Hill and Gringley -	114	51	31,5	32,5
			31,75	
			32,5	
			32,75	
			33,75	
At Gringley.				
Beacon Hill and south end of base -	51	11	5,25	6,5
			5,75	
			6,75	
			7,25	
			7,5	

Between	°	′	″	Mean.
Beacon Hill and north end of Base -	70	28	21,5	″ 22,25
			21,75	
			22,5	
			23,25	
Beacon Hill and Heathersedge -	23	10	5	6
			6	
			7	
Sutton Ashfield and Heathersedge -	46	20	23,5	24
			24,5	

At Heathersedge.

	°	′	″	Mean.
Beacon Hill and Gringley - -	80	40	37,75	38,5
			38,5	
			39,25	
Sutton Ashfield and Gringley -	54	52	36,5	37,5
			37,5	
			38,5	
Orpit and Sutton Ashfield - -	39	8	37,25	38,75
			37,75	
			38,25	
			39,5	
			39,75	

At Sutton Ashfield.

	°	′	″	Mean.
Heathersedge and Gringley - -	78	47	1,25	2
			2,25	
			2,5	
Orpit and Heathersedge - -	60	22	24,5	25,5
			25,5	
			26,5	
Hollan Hill and Orpit - -	113	49	8	9
			9	
			10	

At Orpit.

Between	°	′	″	Mean.
Heathersedge and Sutton Ashfield -	80	28	56,25	″ 57,25
			56,75	
			57,75	
			58,25	
Hollan Hill and Sutton Ashfield -	21	27	19,5	20,5
			20	
			20,5	
			21	
			21,75	
Bardon Hill and Hollan Hill - -	62	8	24,5	25
			25	
			25,5	
Castle Ring and Bardon Hill -	56	3	13,75	14,75
			14,75	
			15,75	

At Hollan Hill.

	°	′	″	Mean.
Sutton Ashfield and Orpit - -	44	43	30,75	32
			32,5	
			32,75	
Bardon Hill and Orpit - -	74	52	36,25	38
			37,75	
			38,75	
			39,25	

At Bardon Hill.

	°	′	″	Mean.
Hollan Hill and Orpit - - -	42	58	58,75	59,5
			59,25	
			59,75	
			60,25	
Castle Ring and Orpit - -	68	24	3,75	4,75
			4,75	
			5,75	
Corley and Arbury Hill - -	38	25	12,5	13,25
			13,25	
			14,25	

At Castle Ring.

Between	°	′	″	Mean.
Bardon Hill and Orpit - - -	55	32	43	″ 44
			43,25	
			43,75	
			44,25	
			44,75	
			45	
Corley and Bardon Hill - -	47	54	40,5	42,25
			41,75	
			42,5	
			43,25	
			43,5	
At Corley.				
Castle Ring and Bardon Hill - -	72	32	45,75	46,5
			46,25	
			46,75	
			47	
Arbury Hill and Bardon Hill -	107	20	13,5	14,25
			14,25	
			15,75	
At Arbury Hill.				
Corley and Bardon Hill - -	84	14	32,5	33,5*
			33,25	
			34,25	

Reduction of the Base to the Temperature of 62°.

	Feet.
The apparent length of the base was 259 chains of 100 feet each, + 8 chains of 50 feet each, and the overplus of the last chain *viz.* 38,321 feet -	26338,321

The chain B, before the measurement, was found to be 16¼ divisions on the micrometer-head shorter

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* For the observations of the angles of the triangles southward of Arbury Hill, see the Philosophical Transactions for 1795 and 1800.

	Feet.
than A, the length of which, according to Mr. RAMSDEN's determination, may be taken = 100 feet + 0,1236 inches, in the temperature of 54°; which gives A 0,12363 parts of an inch too long. Therefore, if to this is added half the wear, *viz.* 0,00192 parts of an inch, we shall get $\frac{0{,}12555}{12}$, which × 259 gives 2,709 feet, which add - - - -	+ 2,709
The 50-feet chain, before the measurement, was compared also with B, and found to be 24 divisions on the micrometer-head longer; therefore, $\frac{0{,}0943}{12} \times 4 = 0{,}0314$ parts of a foot, which likewise add -	+ 0,031
Again, the sum of all the degrees shown on the thermometers was 98083, wherefore, $\overline{\frac{98083}{5} - 54^\circ} \times 263{,}38 \times \frac{0{,}0075}{12} = 3{,}3713$ feet, is the correction for the mean heat in which the base was measured above 54°, the temperature in which the chains were laid off, and this also add - - - -	+ 3,371
Finally, for the reduction to the temperature of 62°, or 8° on the brass scale, we have $\frac{0{,}1237 \times 263{,}38 \times 8^\circ}{12} = 1{,}720$ feet, which subtract - - -	— 1,720
Hence we have the true length of the base, in the temperature of 62°, = - - -	26342,712

The surface of the ground on which this base was horizontally measured, is said to be not more than 35 feet above the surface of the sea, in the mouth of the Humber, at *half tide.* And, although it may not perhaps be a very correct deduction, yet, as I understand that conclusion arose out of a levelling operation, it may be taken for granted that we shall not err, as to sense, in our conclusions, if we consider Misterton Carr as situated on the mean surface of the spheroid. I shall, therefore, take 26342,7 feet for the true length of the base; and I think it cannot exceed or fall short of that quantity, more than two inches.

Recent Comparisons of the standard and working Chains, with the points inserted in the cast Iron Bar.

In the reduction of the foregoing base, I have taken it for granted, that the standard chain is precisely of the same length as when it first came out of the hands of Mr. RAMSDEN. Circumstances which need not be mentioned in this part of my paper, but which, in their proper places, will be explained, have induced me to get both the long chains remeasured. Mr. BERGE, therefore, at my request, prepared the bar and plank, and lately went through the required operation. The particulars were as follow.

The chain B was first measured in five successive removes, the first space of 20 feet having a thermometer in the middle of the bar, which stood at 48°; the second space or remove, having the same thermometer at 48°,2; the third, at 48°,5; the fourth, at 48°,8; and the 5th, at 48°,8; which gave the total length of the chain = 100 feet + 0,077 parts of an inch, in the mean temperature of 48°,6.

The standard A was then measured in five successive removes; the thermometer at each remove being 48°,5 — 48°,6 — 48°,7 — 48°,8 — 48°,8; which gave the length of A = 100 feet + 0,132 parts of an inch, in the temperature 48,°7.

From the Table of expansions in Vol. LXXV. of the Phil. Trans. the difference between the expansion of a rod of steel and one of cast iron, both of ten feet in length, is found to be 0,00001 part of an inch; therefore, the length of the chains, in the temperature of 54°, agreeing with the points on the bar, will be A = 100 feet + 0,1325 inches.

B = 100 feet + 0,0778 inches.

In the Phil. Trans. for 1795, page 437, their lengths, in the same temperature, as deduced by Mr. RAMSDEN, are stated to be A = 100 feet + 0,11425 inches.

B = 100 feet + 0,05825 inches; which gives a difference something less than $\frac{2}{100}$ of inch between their present and former lengths.

In the reduction of the preceding base, I have supposed the working chain A to be 0,12363 parts of an inch too long before the measurement began. If to this the whole wear be added, *viz.* 0,00384, we shall have the length of it, 100 feet + 0,1275 parts of an inch; which differs only $\frac{5}{1000}$ from the late determination of Mr. BERGE.

Calculation of the Sides of a Series of Triangles, extending from Dunnose, in the Isle of Wight, to Clifton, in Yorkshire. Plate XV.

In the former accounts of the trigonometrical operations it will be found, that triangles have been carried on from Dunnose to Arbury Hill. It will be proper to give them in this place, that the series may be complete, thereby superceding the necessity of frequently referring to those papers.

Butser Hill from Dunnose, 140580,4 feet. Phil. Trans. for 1795, p. 501.

No. of triangles.	Names of stations.	Observed angles.	Diff.	Spherical excess.	Error.	Angles corrected for calculation.	Distances.
		° ′ ″	″	″	″	° ′ ″	Feet.
I.	Butser Hill	76 12 22	−1,99			76 12 21,5	
	Dean Hill	48 4 32,25	−1,54			48 4 31,75	
	Dunnose	55 43 7	−1,53			55 43 6,75	
		180 0 1,25		5,0	−3,75		
	Dunnose from Butser Hill						140580,4
	Dunnose from Dean Hill						183496,2
II.	Dean Hill	62 22 48,75	−1,37			62 22 47	
	Butser Hill	48 28 41,5	−1,23			48 28 40	
	Highclere	69 8 35	−1,5			69 8 33	
		180 0 5,25		4,07	+1,18		
	Dean Hill from Butser Hill						156122,1
	Dean Hill from Highclere						125084,9
III.	Butser Hill	84 31 45,5	−1,2			84 31 44,5	
	Hind Head	66 15 54,5	−0,83			66 15 54,25	
	Highclere	29 12 22	−0,72			29 12 21,25	
		180 0 2		2,7	−0,7		
	Butser Hill from Hind Head						78905,7
	Butser Hill from Highclere						148031,0
IV.	Highclere	34 46 15,75	−0,81			34 46 15	
	Hind Head	83 20 14,25	−1,36			83 20 14	
	Bagshot Heath	34 46 15,75	−1,88			61 53 31	
		180 0 1,75		3,09	−1,34		
	Highclere from Bagshot Heath						142952,6
	Highclere from Hind Head						160972,2

No. of triangles.	Names of stations.	Observed angles.	Diff.	Spherical excess.	Error.	Angles corrected for calculation.	Distances.
		° ′ ″	″	″	″	° ′ ″	Feet.
V.	Bagshot Heath -	55 32 26	—0,89			55 32 25,25	
	Highclere -	46 10 18,25	—0,83			46 10 17,75	
	Nuffield - -	78 17 18,25	—1,20			78 17 17	
		180 0 2,5		2,94	—0,43		
	Nuffield from { Bagshot Heath - -						105321,2
	Highclere - - -						120374
VI.	White Horse Hill -	63 7 53,25	—0,94			63 7 53,5	
	Highclere - -	63 18 16,75	—0,94			63 18 17	
	Nuffield - -	53 33 49,5	—0,86			53 33 49,5	
		179 59 59,5		2,74	—3,24		
	White Horse Hill from { Nuffield - -						120557,7
	Highclere - -						108563,1
VII.	White Horse Hill -	38 48 13,25	—0,67			38 48 12,5	
	Nuffield - -	86 4 16,25	—1,21			86 4 15	
	Brill - -	55 7 33,5	—0,71			55 7 32,5	
		180 0 3		2,6	+0,4		
	Brill from - { White Horse Hill -						146603,2
	Nuffield - - -						92805,5
VIII.	Brill - -	50 14 44,5	—1,18			50 14 45	
	White Horse Hill -	64 45 43,75	—1,34			64 45 42,5	
	Stow on the Wold -	64 59 32	—1,35			64 59 32,5	
		180 0 0,25		3,88	—3,63		
	Stow from - { White Horse Hill -						124365,6
	Brill - - -						146326,3
IX.	Brill - -	32 34 43	—0,61			32 34 42,25	
	Stow on the Wold -	60 56 6,25	—0,64			60 56 5,5	
	Epwell - -	86 29 13,25	—0,11			86 29 12,25	
		180 0 2,75		2,37	+0,38		
	Epwell from - { Stow - - -						78938,2
	Brill - - -						128140

No. of triangles.	Names of stations.	Observed angles.	Diff.	Spherical excess.	Error.	Angles corrected for calculation.	Distances.
		° ′ ″	″	″	″	° ′ ″	Feet.
x.	Brill - -	34 23 58,5	−0,65			34 23 57,5	
	Epwell - -	85 0 18,5	−1,10			85 0 17,5	
	Arbury Hill -	60 35 45,5	−0,70			60 35 45	
		180 0 22,5		2,46	+0,04		
	Arbury Hill from { Epwell - - -						83098,4
	Brill - - -						146530
xi.	Arbury Hill -	89 57 4,5	−1,14			89 57 5,5	
	Epwell - -	54 45 18,75	−0,57			54 45 18,25	
	Corley - -	35 17 36,75	−0,57			35 17 36,25	
		180 0 0		2,29	−2,29		
	Corley from - { Arbury Hill - -						117463
	Epwell - - -						143827,8

By the last triangle, the distance from Corley to Arbury Hill is 117463 feet, which distance, and all the others constituting the sides of this part of the series, are deduced from the base on Hounslow Heath, as well as that on Salisbury Plain. With regard to the triangles connecting the stations at Corley and Arbury Hill with the base recently measured in the north, it will be proper to let them rest partly on that base, and partly on the side Corley and Arbury Hill. And here I would remark, that in carrying on a series of triangles, whether for the purpose of a meridional measurement or otherwise, it is proper that a base of verification, answering at the same time as a new one of departure, should be measured every hundred miles at least. With this idea, therefore, the foregoing triangles, as well as those composing the remaining part of the series, should be furnished with three base lines, *viz.* one at each extremity, and the other in the middle. In calculating the sides, were the series thus circumstanced, it would be right to depend on each base for one third of the distance between it and the one next at hand, and use the mean result, as derived from the two adjoining bases, for the true lengths of the several sides within the other third. Thus, if two bases were found at the extremities of the arc in question, and one in the middle, as about Brill, the computation should be carried on, from the extreme bases, about one-sixth part of the meridional distance; and, from the middle base, one-third of the intermediate distance on each side; the remaining two arcs being determined from the respective base lines. That I may avoid prolixity, or the appearance of it, I shall compute the sides of the triangles northward of the two stations before mentioned, from the base measured on Misterton Carr only, and use the mean distances calculated on the above principle, when I find the total length of my arc.

Length of the Base on Misterton Carr, 26342,7 Feet.

No. of triangles.	Names of stations.	Observed angles.	Diff.	Spherical excess.	Error.	Angles corrected for calculation.	Distances.
		° ′ ″	″	″	″	° ′ ″	Feet.
XII.	Beacon Hill -	20 47 19,75				20 47 20	
	North end of Base	60 17 16,5				60 17 13	
	South end of Base	98 55 27,5				98 55 27	
		180 0 3,75					
	Beacon Hill from North end of Base -						64461,7
	Beacon Hill from South end of Base -						73321,9
XIII.	Beacon Hill -	34 44 42,25				34 44 42	
	North end of Base	74 46 56,5				74 46 56	
	Gringley on the Hill	70 28 22,25				70 28 22	
		180 0 1					
	Gringley from North end of Base -						44338,2
	Gringley from Beacon Hill -						75068,0

No. of triangles.	Names of stations.	Observed angles.	Diff.	Spherical excess.	Error.	Angles corrected for calculation.	Distances.
		° ′ ″	″	″	″	° ′ ″	Feet.
XIV.	Beacon Hill - - Gringley - - South end of Base	13 57 24 51 11 6,5 114 51 32,5				13 57 23 51 11 5 114 51 32	
		180 0 3					
	Gringley from Beacon Hill - -						75068,2
	Wherefore the mean distance from Gringley to Beacon Hill is 75068,1 Feet.						
XV.	Heathersedge - Beacon Hill - Gringley - -	18 40 38,5 138 9 16 23 10 6	+0,29 —2,02 +0,65			18 40 38 138 9 16 23 10 6	
		180 0 0,5		1,08	—0,58		
	Heathersedge from { Beacon Hill - - Heathersedge from { Gringley - - -						92227,2 156384,8
XVI.	Sutton Ashfield - Heathersedge - Gringley - -	78 47 2 54 52 37,5 46 20 24	—1,01 —0,24 —0,22			78 47 1 54 52 35 46 20 24	
		180 0 3,5		2,45	+1,10		
	Sutton Ashfield from { Gringley - - - Sutton Ashfield from { Heathersedge - -						130399,7 115339,9
XVII.	Orpit - - Heathersedge - Sutton Ashfield -	80 28 57,25 39 8 38,5 60 22 25,5	—0,85 —0,12 —1,00			80 28 57 39 8 38 60 22 25	
		180 0 1		2,03	—1,03		
	Orpit from - { Heathersedge - - Orpit from - { Sutton Ashfield - -						101660,3 73826,6

No. of triangles.	Names of stations.	Observed angles.	Diff.	Spherical excess.	Error.	Angles corrected for calculation.	Distances.
		° ′ ″	″	″	″	° ′ ″	Feet.
XVIII.	Hollan Hill -	44 43 32	−0,12			44 43 31	
	Sutton Ashfield -	113 49 9	−0,53			113 49 7	
	Orpit - -	21 27 20,5	−0,18			21 27 22	
		180 0 1,5		0,73	+0,77		
	Hollan Hill from { Sutton Ashfield - -						38375,2
	Orpit - - - -						95975,3
XIX.	Bardon Hill - -	42 58 59,5	−0,69			42 58 59	
	Hollan Hill -	74 52 38	−1,03			74 52 37	
	Orpit - -	62 8 25	−1,01			62 8 24	
		180 0 2,5		2,75	−0,20		
	Bardon Hill from { Hollan Hill - - -						124454,7
	Orpit - - -						135895,3
XX.	Castle Ring -	55 32 44	−0,94			55 32 43	
	Bardon Hill -	68 24 4,75	−1,02			68 24 3	
	Orpit - -	56 3 14,75	−0,90			56 3 14	
		180 0 3,5		2,85	+0,65		
	Castle Ring from { Orpit - - -						153235,2
	Bardon Hill - - -						136717,8
XXI.	Corley -	72 32 46,5	−1,19			72 32 46	
	Castle Ring -	47 54 42,25	−0,86			47 54 42	
	Bardon Hill -	59 32 32,25	−0,94			59 32 32	
		180 0 1		2,93	−1,93		
	Corley from - { Bardon Hill - -						106357,3
	Castle Ring - -						123539,7
XXII.	Arbury Hill -	34 14 33,5	−0,98			34 14 33	
	Corley - -	107 20 14,25	−1,99			107 20 14	
	Bardon Hill -	38 25 13,25	−0,80			38 25 13	
		180 0 1		3,37	−2,37		
	Arbury Hill from { Bardon Hill - -						180426,0
	Corley - - - -						117457,1

From the last triangle, we get 117457,1 for the distance between Corley and Arbury Hill. By the XI. triangle, the distance between those stations is 117463 feet; there is, therefore, a difference of nearly six feet between the two determinations; a quantity which cannot be considered unexpectedly great, as the side is more than twenty-two miles in length, and the whole series nearly two hundred miles long. If the computation had been carried on from Dunnose all the way up, the bases on Hounslow Heath and Salisbury Plain would have given the length of that on Misterton Carr about one foot greater than its measured extent. If the sides of the triangles contiguous to Corley and Arbury Hill be recomputed, from the mean distance between those stations, *viz.* 117460 feet, no doubt whatever can be justly entertained of the general accuracy of the whole. These mean distances, as I have before observed, will be used in the calculations of the total length of the meridional arc. From the Base in the north, I have numbered the triangles downwards: the reason is obvious.

Calculation of the meridional Distance between Dunnose and Clifton.

To do this, it will be right to compare the distances of the several stations from the respective perpendiculars, both of Dunnose and Clifton, as derived from the observed direction of each meridian.

In the Phil. Trans. for 1795 it will be seen, that the direction of the meridian was observed at the station on Dunnose, in 1793, the staff to which the pole star was referred being placed on Brading Down. The angle between that staff and the meridian, (see page 517 of that volume,) was found to be 21° 14′ 11″,5, as derived from two double azimuths of the star, supported by several computed azimuths, applied to single but accurate observations.

The angle between Butser Hill and the staff at Brading Down, was 0° 15′ 35″,5. This, with the above angle, 21° 14′ 11″,5, and particular angles of the series, gives,

The Bearings of certain Sides from the Parallels to the Meridian of Dunnose.

Dunnose and Butser Hill	20° 58′ 39″	NE
Butser Hill and Highclere	34 20 17	NW
Highclere and Nuffield	35 30 40	NE
Nuffield and Brill	4 51 15	NW
Brill and Arbury Hill	12 30 17	NW
Arbury Hill and Bardon Hill	7 42 57	NW
Bardon Hill and Orpit	21 21 9	NW
Orpit and Heathersedge	5 25 52	NW
Heathersedge and Beacon Hill	61 52 17	NE.

These bearings, and the respective sides, give the following distances on the meridian of Dunnose, *viz.*

	Feet.	Miles.
Dunnose and Butser Hill	131263,0 =	24,86
Butser Hill and Highclere	122232,7 =	23,15
Highclere and Nuffield	97984,7 =	18,56
Nuffield and Brill	91755,3 =	17,38
Brill and Arbury Hill	143054,1 =	27,09
Arbury Hill and Bardon Hill	178792,4 =	33,86
Bardon Hill and Orpit	126567,8 =	23,97
Orpit and Heathersedge	101203,7 =	19,17
Heathersedge and Beacon Hill	43480,7 =	8,23
	1036334,4 =	196,27, the distance

between Clifton and the perpendicular to the meridian of Dunnose; which may be taken for the true length of the arc itself, as the distance of the former station from the meridian of the latter, is only 4770 feet.

If the angle between the meridian and the staff at Brading Down was observed accurately, there can be no doubt of the correctness of this determination; but, as it was right on my part to adopt measures for bringing it to some proper test, I observed, as before stated, the direction of the meridian at Clifton. The particulars were as follows.

Observed Angles between the Pole Star, when at its greatest Elongations from the Meridian of Clifton, and the Staff erected over the Station at Gringley on the Hill.

August, 1801.

Days.		Evenings.	Mornings.
9th.	-	100° 45′ 46″	
10th.	-	100 45 43,5	
11th.	-	100 45 45,5	106° 39′ 34″
13th.	-	100 45 39	106 39 22
16th.	-	100 45 40,5	
17th.	-	100 45 41	106 39 24
18th.	-	100 45 39	106 39 28
19th.	-	100 45 46,5	106 39 27.

If a mean of all the evening observations be taken, we shall get 100° 45′ 42″,8, for the angle between the staff at Gringley and the star when at its greatest eastern elongation from the merdian. In like manner, if a mean of all the morning observations be taken, we shall have 106° 39′ 27″, for the angle between the same staff and the star on the western side. Hence, half their sum, 103° 42′ 35″, nearly, will be the angle between Gringley and the meridian of Clifton; and its south-eastern bearing 76° 17′ 25″. This, with certain angles of the series, gives the bearings of the following sides, *viz.*

Beacon Hill and Heathersedge	61°	51′	50″	SW
Heathersedge and Orpit	5	26	19	SE
Orpit and Bardon Hill	21	21	36	SE
Bardon Hill and Arbury Hill	7	43	26	SE
Arbury Hill and Brill	12	31	0	SE
Brill and White Horse Hill	50	15	48	SW
White Horse Hill and Highclere	27	48	6	SE
Highclere and Butser Hill	34	20	49	SE
Butser Hill and Dunnose	20	58	9	SW.

These bearings and sides give the following parallels to the meridian of Clifton.

	Feet.
Beacon Hill and Heathersedge	43490,4
Heathersedge and Orpit	101202,6
Orpit and Bardon	126561,3
Bardon Hill and Arbury Hill	178793,2
Arbury Hill and Brill	143047,4
Brill and White Horse Hill	93717,6
White Horse Hill and Highclere	96031,4
Highclere and Butser Hill	122219,8
Butser Hill and Dunnose	131270,2

The sum, 1036333,9 feet, is the distance between Dunnose and the perpendicular to the meridian of Clifton; or, as observed with regard to the sum of the parallels to the meridian of the former, the length of the arc itself.

There is, therefore, a difference of only half a foot, between the two results. We may, consequently, take 1036334 feet, for the distance required.

I have observed, in a former part of this account, that the zenith sector was placed 6½ feet from the station at Dunnose, and 3½ feet from that at Clifton, the new points being due south of the old. We must therefore add 3 feet to 1036334; which gives 1036337 feet, for the total length of the arc of the meridian.

The sum of the parallels to the meridian of Clifton, reaching down to Arbury Hill, is 450047,5 feet; and the distance of the latter from that meridian 1996 feet. This is, in fact, the meridional extent between the two old stations, as no correction is requisite. We must, however, subtract 30 feet from this distance, as the sector was put up 34½ feet northward of the station on Arbury Hill. Therefore, 450047,5 — 30 = 450017,5 feet, is the length of the arc comprized between the parallels of the new stations at Clifton and Arbury Hill: and, subtracting this from 1036337, we have 586319,5 feet, for the distance of this latter station from the point over which the sector was placed at Dunnose.

Although the zenith sector was taken to the Royal Observatory at Greenwich, rather with a view of collecting materials for finding the latitude of Dunnose, than to answer any other purpose, yet, as I am provided with the means of finding the meridional distance between those places, and that with sufficient accuracy, I shall go through the work in this place.

Distance between the Parallels of Latitude of Greenwich and Dunnose.

In the Phil. Trans. for 1795, the station on Beachy Head is shown to be 269328 feet from the perpendicular at Greenwich, and 58548 from its meridian. In Plate XVI. Fig. 2, of this account, let DPB be a great spheroidical triangle on the earth's surface, P the pole, and D B the two stations at Dunnose and Beachy Head. Let also PGM be the meridian of Greenwich, [G,] and M the point where the parallel of Beachy Head to the perpendicular at G cuts that meridian. Then, from the above values of GM and BM, it will be found, that the latitude of B is 1″,03 less than the latitude of M, and that too on any hypothesis of the earth's figure. Therefore, the distance in feet, between the parallels of B and G, is 269328 + 103 = 269431.

Now it has been shown, in the volume above referred to, (see page 522,) that the meridional distance between D and B is the mean of the two numbers 44258,6 and 44258,9 feet; and it must be remembered that, in deducing those conclusions, recourse was not had to matters of assumption, but to matters of fact, which were, the observed directions of the two meridians PD, PB, and the distance DB. Therefore, if 44259 feet be taken for the meridional distance between D and B, we shall have 269431 + 44259 = 313690 feet, for the space between the parallels of latitude of Greenwich and Dunnose.*

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* In the Phil. Trans. for 1800, (see note to page 641,) in finding the value of the oblique arc between Black Down, in Dorsetshire, and Dunnose, I have used the expression $\frac{pm}{p+\overline{m-p}\,.\,s^2} = d$; where d is the length of the required degree, p that of the great circle perpendicular to the meridian, m that of the degree of the meridian itself, and s the sine of the angle constituted by the oblique arc and the meridian.

We have then found the total length of the whole meridional arc, and also the distances of two intermediate points from either, or from both, of its extremities. And, to bring the whole

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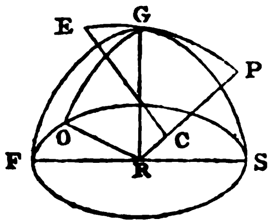
The demonstration of this rule I did not insert, on account of the previous length of the note alluded to; but I take this opportunity of supplying the omission, in the words of Mr. DALBY.



Having the length of the degree on the meridian, and also that of the degree perpendicular to it, at the same point; to find the length of a degree in any other given direction, supposing the earth to be an ellipsoid.

Let EP be one-fourth of the elliptic meridian; C the centre of the earth; CE, CP, the equatorial and polar semiaxes; G a given point on the meridian EP. Draw GR perpendicular to the meridian at G, meeting the axis PR in R; then RG is the radius of curvature of the ellipse, at the point G, which is perpendicular to the meridian at G.

Conceive another ellipsoid FGSO to touch the given one in the point G. Then, it is evident, that if the curvature be respectively the same in the direction of the meridian and the perpendicular, on both ellipsoids at the point G, the curvature will also be equal on both figures, in any other direction at that point. And the like is manifest in spheroids of any other kind.

Let M be the radius of curvature of the meridian at the point G; then, because RG is the radius of curvature in the perpendicular direction, if we take FS (at right angles to RG) $= 2\sqrt{RG \times M}$, and about FS, the axis to the semidiameter RG, describe the ellipsoid FGSO, it will be *that* having the curvature of G the same as on the other ellipsoid at that point.

Let OGR be the plane of an ellipse, inclined to the meridian EGP, or to the plane FGS, in a given angle FRO, whose *sine* and *cosine* are s and c. Then, since RG, or rather its equal, is a semitransverse, in the plane FOSR, (which is perpendicular to RG,) to the semiconjugate RF, we shall have $\frac{RG^2 \times RF^2}{RG^2 c^2 + RF s^2} = RO$, which, divided by RG, (RG being the semitransverse to RO in the perpendicular plane ROG,) gives $\frac{RG \times RF^2}{RG^2 c^2 + RF^2 s^2}$ for the radius of curvature of the inclined ellipse OG at the point G. But, because the lengths of the degrees are proportional to their radii of curvature, if we put m and p for the meridional and perpendicular degrees, then RF or $\sqrt{RG \times M}$ and RG may be expounded by $\sqrt{pm}$, and p; hence, the expression will become $\frac{pm}{pc^2 + ms^2}$, for the length under one point of view for future use, we shall have the following

Arcs.

	Feet.		Miles.
1. Clifton and Dunnose -	1036337	=	196,27
2. Dunnose and Arbury Hill -	586320	=	111,05
3. Dunnose and Greenwich - -	313696	=	59,41
4. Clifton and Arbury Hill -	450017	=	85,23
5. Clifton and Greenwich - -	722641	=	136,86
6. Arbury Hill and Greenwich -	272624	=	51,63

Remark.

In calculating the distance between the parallels of latitude of two places, connected by means of a trigonometrical operation, regard must be had to their difference in longitude. If the triangles run nearly north and south, in which case stations must lie both east and west of the two meridians, it is sufficiently correct to proceed on the supposition of the earth's surface being a plane; but if, on the contrary, the triangles wholly diverge from the two meridians, or even partly do so, first running off obliquely and then returning again, a different

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of the degree oblique to the meridian; or, putting $1 - s^2$ for c^2, and r for $p - m$, it will be $\frac{pm}{p - rs^2}$.

Corol. If d be the length of the oblique degree, then, since $d = \frac{pm}{pc^2 + ms^2}$, we have $p = \frac{s^2 dm}{m - c^2 d}$, and $m = \frac{c^2 dp}{p - s^2 d}$. And, if D be put for the length of another oblique degree at the same point, and S and C the *sine* and *cosine* of its inclination to the meridian, we shall get $m = \frac{S^2 c^2 - C^2 s^2}{S^2 D - s^2 d} \times Dd$, and $p = \frac{S^2 c^2 - C^2 s^2}{c^2 d - C^2 D} \times Dd$, the meridional and perpendicular degrees, exhibited in terms of the oblique degrees combined with the sines and cosines of their inclinations to the meridian. Therefore, an ellipsoid may be determined from the lengths of two oblique degrees in the same latitude.

We may likewise remark, from the nature of radii of curvature, at the same point G, that the expression $\frac{pm}{p - rs^2}$ will also give the oblique degree on different spheroids.

method must be pursued. The necessity giving rise to this, originates from the radii of curvature of the oblique degrees continually varying, and the angles of convergency, between the several sides and their respective meridians, remaining unknown.

It must be remembered, that the sides of the several triangles projected over the country, in this Survey, are not to be considered as so many distances on the earth's surface, but the lengths of the chord lines subtended by arcs. Therefore, it is manifest that, strictly speaking, all the chord angles should be used, and not the horizontal ones; with which, after the bearing of the first side with the meridian has been reduced to some plane beneath the earth's surface, a number of chord lines in the plane of that meridian are to be computed; the sum of which, augmented by the differences between those chords and their respective arcs, will give the true meridional distance. I have been at the trouble to calculate the distance between Clifton and Dunnose on this principle; and find the length of my arc to be 1036339,5 feet; which is, about 2½ feet more than the distance determined by the other mode of computation. An advantage, however, attending a calculation on the principle now spoken of, is the ability of calculating, pretty nearly, the azimuth of any one station from an extremity of the arc. This, if the instrument with which the direction of the meridian is observed be not well divided, or otherwise not exactly fit for the operation, is necessary, and should be always done. The angle at Clifton, between Gringley on the Hill and the meridian, was observed to be 76° 17′ 25″. According to my computation in the way spoken of, that angle is 76 17′ 30″. A difference of 5″, working all the way up from Dunnose through an arc of 2° 50′, is as small as can be expected, and serves to prove that the angles of the triangles, as well as the observed direction of the meridians, are consistent. I have given the meridional distance between Clifton and Dunnose, bearings of the sides, &c. deduced from the most simple of the two methods; first, because the result is sufficiently accurate; secondly, because it places within general reach, the means of examining this part of my operation. In attending to this remark, it must be remembered, that a line from Dunnose perpendicular to the meridian of Clifton, is only 4853 feet.

SECTION SECOND.

Operations at the Station on Dunnose, the Southern Extremity of the Arc, with the Zenith Sector. May and June, 1802.

On the 8th of May, the circular or large theodolite was placed over the point selected for a new station: its distance was 6½ feet from the gun, and in a direction due south. The following objects were then observed, the readings of which, on the graduated limb, were as follows.

Sir R. Worsley's obelisk (the top)	113° 14′ 28″
East Cowes sea mark	1 46 36,5
Luttrell's Folly	177 56 25
Vane on the top of Portsmouth Church	40 6 44,5
Sir R. Worsley's obelisk, a second time	113 14 24,25

The above objects were observed, in order that no possible mistake might result; as (though not probable) accidental circumstances might have given rise to a wrong statement of the bearing of some one of the number, (except Portsmouth Church,) in the account of 1795. Omitting the obelisk, the bearings of the other objects, as extracted from that Paper, will be as follows.

Luttrell's Folly	23°	0′	44″	NW	from the meridian of Dunnose.
East Cowes sea mark	19	11	19	NW	
Portsmouth Church	19	9	40	NE	

If, from the readings on the limb, the angles between the obelisk and the other objects be taken, and applied to the last-mentioned bearings, we shall get the angle between the obelisk and the meridian, 87° 42′ 40″
35 } Mean, 87° 42′ 40″.
45

May 9th. Erected the observatory, drove four long stakes into the ground, and brought their several heads into the same horizontal plane. Then erected the stand, set up the sector, and adjusted the axis level, and the axis itself; determined the exact weight the plumb-line would bear, and then examined how much the cross wires were out of their proper positions, as follows.

The stand being firmly screwed down to the stakes, the sector was turned on its axis, till the pointed top of Sir Richard Worsley's obelisk appeared in the field; it was then clamped to the azimuth circle, but subject to a small motion by turning an adjusting-screw. The pointed apex was then made to appear as just vanishing under the wires; in which situation of things, the side telescope was turned round, and laid in its several positions on the brass frame attached for its reception to the side of the sectorial tube; the top of the obelisk appearing as a vanishing point under the wires. On whichever face of its squares it was made to rest, the vernier of the azimuth circle read off to 84° 5′. The little telescope was then taken out of its frame, and the sector turned half round. It was then again introduced into its supports, and the interior stand moved, till the wires in the focus of the lateral telescope appeared on the obelisk as before. The vernier was then examined, which again stood at 84° 5′. This being settled, the sector was turned round, till its vernier stood at 176° 22′ on the azimuth circle, in which situation, the plane of the divided arc was necessarily parallel to that of the meridian. The task of observation then commenced, and the performance of it was as follows.

Observations made at Dunnose, to determine the Zenith Distance of β Draconis.

Point on the Limb, 1° 50′ North.

Day of the month.	Face of the arch, W. or E.	Plumb-line.	Observation of the star.	Zenith distance in revolutions and parts.	Zenith distance reduced.	Barometer.	Thermometer.	
							Above.	Below.
1802		rev. div.	rev. div.	° ′ rev. div.	° ′ ″	Inches.	°	°
May 11	W	9 4,82	9 17,9	1 50 0 13,08	1 49 46,90	28,85	43,5	43,5
13	E	9 16,95	8 56,0	19,95	40.02	28.85	36,5	38,0
14	W	9 34,25	9 47,5	13,25	46,73	28,92	34,5	34,5
16	E	8 32,16	8 14.0	18,16	41,81	28,82	35,5	34,5
June 5	W	6 23,00	6 30,0	7,00	52,99	28,45	51,5	51,5
8	E	8 14,02	8 2,0	12,02	47,96	28,49	52,0	51,8
11	W	6 57,40	7 2,6	4,20	55,79	28,54	52,5	52,0
13	E	9 39,50	9 29,5	10,00	49.98	28,79	53,0	52,7
14	W	8 19,29	8 23,7	4,41	55,58	28,86	54,2	53,0
16	E	3 56,61	3 47,0	9.61	50,37	28,75	59,5	60,0
17	W	8 38.52	8 41,5	2,98	57,02	28,82	56,1	58,0
18	E	11 31,87	11 21,5	10,37	49,61	28,81	52,0	51,0
20	W	8 53,27	8 54.2	0,93	59,07	29,03	57.5	58,0
.21	E	10 27,05	10 19,7	7,35	52,64	28,99	56,5	55,5

Observed Zenith Distances of γ Draconis.

Point on the Limb, 0° 50′ North.

Day of the month.	Face of the arch, W. or E.	Plumb-line.	Observation of the star.	Zenith distance in revolutions and parts.	Zenith distance reduced.	Barometer.	Thermometer. Above.	Thermometer. Below.
		rev. div.	rev. div.	° ′ rev. div.	° ′ ″	Inches.	°	°
May 10	E	10 15,52	13 48,1	0 50 3 32,75	0 53 30,10	29,0	—	45,0
11	W	9 38,66	5 56,4	41,26	38,62	28,85	43.9	43,5
13	E	8 47,30	12 81,4	34,10	31,45	28,85	36,5	38,0
14	W	7 32,38	3 49,2	42,18	39,54	28,92	34,5	34,5
16	E	9 40,00	13 15,2	34,20	31,55	28,82	35,5	36,5
June 11	W	7 20.70	3 29,5	50,20	47,58	28,34	53,5	52,5
13	E	9 36,35	13 20,3	42,95	40,31	28,79	52,5	52,3
14	W	8 25,26	4 33,4	50,86	48,24	28,26	51,3	53,0
16	E	9 48,33	14 37,4	45,07	43,44	28,75	59,5	60,0
17	W	8 32,66	4 39,4	52,26	49,64	28,82	56,0	58,0
18	E	11 32,77	15 17,9	44,13	41,50	28,8	52,0	51,0
20	W	8 9,48	4 17,0	51,48	48,86	29.97	58,6	57,0
21	E	11 52,92	15 40,0	47,08	44,45	28,83	56,0	55,5

Observed Zenith Distance of 45 d Draconis.

Point on the Limb, 6° 15′ North.

June 13	E	9 27,76	10 53,1	6 15 1 25,34	6 16 24,48	28,8	49,5	51,0
14	W	9 23,81	7 48,5	34,31	33,30	28,86	54,0	53,0
16	E	10 18,90	11 46,5	27,60	26,74	28,77	59,0	59,5
18	W	11 11,65	9 32,9	37,75	36,91	28,8	58,5	52,7
20	E	8 18,20	9 46,7	28,50	27,64	28,97	56,0	55,5
21	W	11 31,03	9 52,7	37,33	36,49	28,99	56,0	55,5

Observed Zenith Distance of 46 c Draconis.

Point on the Limb, 4° 40′ North.

June 13	E	9 34,85	12 46,0	4 40 3 11,15	4 43 8,46	28,8	49,5	51,0
14	W	8 16,17	4 53,0	20,17	17,50	28,86	51,7	50,5
16	E	13 15,62	16 27,0	11,38	8,69	28,77	59,0	59,5
18	W	11 10,40	7 41,3	18,10	15,42	28,8	52,7	50,5
20	E	8 32,10	11 47,0	14,90	12,22	28,97	58,4	57,0
21	W	11 5,13	7 43,1	21,03	18,36	28,99	56,0	55,5

Observed Zenith Distance of 51 *Draconis.*

Point on the Limb, 2° 25′ *North.*

Day of the month	Face of the arch, W. or E.	Plumb-line.	Observation of the star	Zenith distance in revolutions and parts.	Zenith distance reduced.	Barometer.	Thermometer. Above.	Thermometer. Below.
		rev. div.	rev. div.	° ′ rev. div.	° ′ ″	Inches	°	°
June 13	E	7 42,00	13 11,5	2 20 3 28,50	2 23 25,84	28,8	49,5	51,0
14	W	8 10,63	4 33,3	36,33	33,68	28,9	51,8	50,5
16	E	9 0,00	12 28,8	28,80	26,14	28,8	59,0	59,5
18	W	10 48,27	7 11,5	36,77	34,12	28,8	50,2	50,0
20	E	8 47,43	12 21,0	32,57	29,92	29,0	55,0	56,0
21	W	11 2,23	7 24,5	36,75	34,08	29,0	53,5	55,0

Observed Zenith Distance of μ *Draconis.*

Point on the Limb, 4° 5′ *North.*

May 11	W	9 18,20	7 31,6	4 5 1 45,60	4 6 44,73	28,85	43,5	43,5
13	E	13 3,04	11 39,0	46,01	35,17	28,85	40,5	41,0
14	W	10 2,03	8 18,4	42,63	41,80	28,92	36,3	38,5
June 8	E	8 12,56	9 57,1	44,54	43,71	28,51	51,5	51,0
13	E	9 29,34	11 15,8	45,46	44,63	28,79	53,5	51,5
14	W	8 29,56	6 34,7	53,86	53,05	28,86	53,5	54,0
16	E	4 9,66	5 56,0	46,34	45,51	28,75	59,5	60,0
17	W	8 45,33	6 50,5	53,83	53,02	28,82	56,0	58,0
18	E	11 44,83	13 34,0	48,17	47,35	28,80	52,0	51,1
20	W	8 44,96	6 47,0	54,96	54,15	29,0	58,2	58,0
21	E	10 34,60	12 25,0	49,40	48,58	28,99	55,8	55,5

Observed Zenith Distance of 16 *Draconis.*

Point on the Limb, 2° 40′ *North.*

May 11	W	10 2,08	7 43,0	2 40 2 18,08	2 42 16,30	28,85	43,5	43,5
14	W	10 27,15	8 9,0	18,15	16,37	29,92	36,5	37,2
16	W	8 31,87	6 14,0	17,87	16,09	28,82	39,0	39,9
June 5	W	9 38,25	7 11,5	26,75	24,99	28,54	53,5	52,0
13	E	4 28,90	1 48,3	39,60	37,86	28,86	52,0	51,5
14	W	8 31,63	6 4,0	27,63	25,87	28,86	53,5	54,0
16	E	3 51,90	6 14,5	21,60	19,83	28,78	61,0	60,2
18	E	11 28,70	13 50,1	21,40	19,63	28,80	51,5	52,7
20	W	8 25,61	5 55,2	29,41	27,65	28,95	57,7	58,5

Observed Zenith Distance of 1 κ *Cygni.*
Point on the Limb, 2° 20′ *North.*

Day of the month.	Face of the arch, W. or E.	Plumb-line.	Observation of the star.	Zenith distance in revolutions and parts.	Zenith distance reduced.	Barometer.	Thermometer.	
							Above.	Below.
		rev. div.	rev. div.	° ′ rev. div.	° ′ ″	Inches.	°	°
June 13	E	9 26,60	12 33,5	2 20 3 6,90	2 23 4,20	28,8	50,0	50,5
14	W	5 54,98	2 37,0	17,98	15,30	28,9	52,1	50,0
16	E	8 49,45	6 52,9	1 55,55	5,26	28,8	59,9	59,0 •
18	W	10 12,05	6 58,8	2 20 3 16,25	13,57	28,8	50,1	50,0
20	E	9 9,83	12 20,0	10,17	7,48	29,0	54,9	56,10
21	W	11 1,83	7 44,2	16,63	13,95	29,0	55,0	53,5

• Point on the limb 2° 25′.

Observed Zenith Distance of 10 ι *Cygni.* ‡
Point on the Limb, 0° 40′ *North.*

June 13	E	9 30,95	10 55,2	0 40 1 24,25	0 41 23,39	28,8	50,0	50,5
14	W	6 50,05	4 51,8	32,25	31,40	28,9	51,7	50,5
16	E	8 43,00	10 9,5	25,50	24,64	28,8	60,0	59,0
18	W	9 38,90	8 26,0	32,90	32,05	28,8	50,2	50,0
20	E	8 30,78	10 0,0	28,22	27,36	29,1	55,0	56,0
21	W	11 19,80	9 45,1	33,70	32,85	28,9	55,0	55,5

Observed Zenith Distance of γ *Ursæ.*
Point on the Limb, 4° 10′ *North.*

May 9	E	11 42,53	12 14,6	4 10 0 31,07	4 10 31,12	—	—	—
10	E	11 10,60	11 42,5	31,90	31,95	29,0	52,0	52,0
11	W	8 34,32	7 54,4	38,92	38,98	28,8	50,5	51,5
13	E	9 54,86	10 29,5	33,64	33,69	28,8	45,7	44,3
14	E	10 1,47	10 34,5	33,03	33,08	28,9	38,5	38,5
15	W	7 15,49	6 33,6	40,89	40,96	28,9	41,0	41,5
17	E	8 54,00	9 29,5	34,50	34,56	28,8	46,0	42,5
20	E	13 43,03	14 18,1	34,07	34,13	28,7	50,5	51,0
June 5	W	9 21,10	8 35,5	43,60	43,67	28,4	53,0	55,1
8	E	8 58,90	9 36,2	37,30	37,36	28,5	55,5	58,5
12	E	5 46,50	6 22,4	34,90	34,96	28,6	54,0	54,0 †
13	W	10 40,70	9 56,4	43,30	43,37	28,7	59,1	59,0
14	W	7 16,40	6 53,0	42,40	42,47	28,9	60,4	59,3
16	E	9 3,20	9 41,1	38,00	38,06	28,8	72,0	69,5

† Imperfect observations.

‡ In page 417, 10 ν Cygni should be 10 ι, ξ Ursæ should be ζ, 85 ν Herculis should be 85 ι, and υ Herculis should be ν.

Observed Zenith Distance of η Ursæ.
Point on the Limb, 0° 15′ South.

Day of the month.	Face of the arch, W. or E.	Plumb-line.	Observation of the star.	Zenith distance in revolutions and parts.	Zenith distance reduced.	Barometer.	Thermometer. Above.	Thermometer. Below.
		rev. div.	rev. div.	° ′ rev. div.	° ′ ″	Inches.	°	°
May 10	E	10 6,74	6 8,6	0 15 3 57,14	5 18 54,53	29,0	49,1	49,0
13	E	9 48,22	5 49,1	58,12	55,51	28,9	40,5	41,0
14	W	10 47,74	14 39,6	50,86	48,24	28,9	36,5	38,5
15	E	10 9,99	6 11,1	57,89	55,28	28,9	41,0	41,5
16	W	9 13,31	13 5,0	50,69	48,07	28,8	39,0	39,9
17	E	9 0,46	5 3,2	56,26	53,65	28,8	46,0	42,5
June 5	W	7 58,15	11 46,3	47,15	44,52	28,5	52,3	52,3
8	E	9 6,37	5 11,6	53,72	51,10	28,5	52,0	56,0
11	W	9 28,50	13 12,7	43,20	40,57	28,5	52,0	55,5
12	E	5 32,60	1 59,0	52,60	49,98	28,6	57,5	56,0
13	W	10 14,50	14 4,0	48,50	49,87	28,7	56,5	56,5
14	E	7 47,52	4 0,4	47,12	44,49	28,8	57,0	56,5 *
16	W	9 4,21	12 49,7	45,49	42,86	28,8	64,0	63,5
18	W	9 14,50	13 0,5	45,00	42,37	28,8	59,5	57,5
20	E	9 6,03	5 13,9	51,13	48,41	28,8	67,0	70,5
21	E	12 45,00	8 57,5	50,50	47,87	28,9	55,5	56,0

* **Doubtful.**

Observed Zenith Distance of ζ Ursæ.
Point on the Limb, 5° 20′ North.

May 11	W	9 19,98	8 44,3	5 20 0 34,68	50 20 34,74	28,8	48,9	49,5
13	E	9 37,00	10 5,5	27,50	27,54	28,8	45,1	44,1
17	E	8 49,96	9 20,5	29,54	29,59	28,8	46,0	42,3
June 5	W	8 31.92	7 51,9	39,02	39,08	28,5	52,3	52,3
8	E	8 56,50	9 28,1	30,60	30,65	28,5	52,0	56,0
11	W	9 36,93	8 55,6	40,33	40,00	28,5	54,0	55,0
14	E	7 47,74	8 23,0	34,26	34,32	28,5	60,5	59,5
17	E	9 33,12	10 8,2	34,08	34,14	28,8	64,0	65,0
18	W	9 28,30	8 45,0	42,30	42,37	28,7	57,5	59,5
20	E	8 54,12	9 30,2	35,08	35,14	28,8	67,0	70,5

Observed Zenith Distance of 85 ι Herculis.
Point on the Limb, 4° 25′ South.

May 10	E	15 16,87	9 50,6	4 25 5 25,27	4 30 20,80	29,0	45,5	45,5
13	E	8 28,70	3 2,5	26,20	21,73	28,8	40,5	41,0
14	W	8 24,16	13 43,0	18,34	14,36	28,9	34,5	34,5
16	E	9 36,40	4 11,2	25,20	20,23	28,8	35,5	35,5
June 14	W	8 25,36	13 33,6	8,24	3,74	28,8	54,0	53,0

Observed Zenith Distance of υ Herculis.

Point on the Limb, 4° 0′ South.

Day of the month.	Face of the arch, W. or E.	Plumb-line.	Observation of the star.	Zenith distance in revolutions and parts.	Zenith distance reduced.	Barometer.	Thermometer. Above.	Thermometer. Below.
		rev. div.	rev. div.	° ′ rev. div.	° ′ ″	Inches.	°	°
May 11	W	9 25,06	10 55,0	4 0 1 29,94	4 1 29,09	28,8	43.5	43.5 *
13	E	10 3,86	8 12,2	50,66	49,84	28,8	40,5	41,0
14	W	9 44.22	11 27,6	42,38	41,55	28,9	34.5	35.5
16	W	2 56,33	4 40,3	42,97	42,14	22,8	39,0	39.9
June 5	W	6 25,10	8 3,6	37,50	36,66	28,4	50,5	51,0
11	W	9 26,10	11 21,0	53,90	53,09	28,5	53.5	52,0
13	E	9 58,25	8 17,0	41,25	40,42	28,8	52,0	51,5
14	W	9 27,50	11 3,5	35,00	34,16	28,7	54.7	54.5
16	E	3 53.47	2 13,0	40,47	39,63	28,8	61,0	60,2
18	E	11 42,00	13 23,0	40,00	39,17	28,8	51,5	52,7
20	E	9 34,90	7 53.4	40,50	39,66	28,9	57.7	52,5

* Imperfect observation.

Observed Zenith Distance of 52 Herculis.

Point on the Limb, 4° 15′ South.

May 13	E	9 52,55	7 32,0	4 15 2 20,55	4 17 18,78	28,8	40,5	41,0
14	W	10 16,56	12 30,4	13,84	12,06	28,92	34.5	35.5
16	E	8 21,44	6 1,6	19,84	18,07	28,8	39,0	39.9
June 8	E	8 9.40	5 55,0	13.40	11,62	28,5	52,5	55.5
11	W	9 29.24	11 34.5	5,26	3.46	28,5	53.5	52,0
13	E	9 33.39	7 21,4	11,99	10,20	28,8	53.5	51,5
14	W	8 28,36	10 32,2	3.84	2,04	28,7	53.5	54,0
16	E	9 8,60	6 56,5	11,11	9.32	28,8	59.5	60,0
17	W	8 57.87	11 4,0	5.13	3.33	28,8	57.5	58,0
18	E	11 39.57	9 31,1	8,47	6.68	28,8	51,5	52.7 †
20	W	8 44.61	10 48,0	3.39	1,59	28.9	57.7	58,5
21	E	10 7,00	7 56,4	9,60	7,81	28,9	59.5	57.5

† Imperfect observation.

Observed Zenith Distance of 22 τ Herculis.

Point on the Limb, 3° 45′ South.

Day of the month.	Face of the arch, W. or E.	Plumb-line.	Observation of the star.	Zenith distance in revolutions and parts.	Zenith distance reduced.	Barometer.	Thermometer.	
							Above.	Below.
		rev. div	rev. div.	° ′ rev. div.	° ′ ″	Inches.	°	°
May 10	E	11 1,72	6 0,7	3 45 5 1,02	3 49 56,51	29,0	—	49,0
11	W	9 28,35	14 21,1	4 51,75	48,23	28,8	43,5	43,5
13	E	9 56,10	4 57,0	58,10	54.59	28,8	40,5	41,0
14	W	10 26,95	15 17,8	49,85	46,32	29.9	36,5	38,5
16	W	8 27,50	13 19,0	50,50	46,98	28,8	39.0	39,9
June 5	W	6 24.95	11 10,2	44,25	40,72	28,4	50,5	51,0
8	E	8 46,08	3 50,7	49.38	45,85	28,5	50,5	52,5
11	W	9 31,31	14 14,4	42,09	38,55	28,5	53,5	52,0
13	E	9 35.50	4 46,5	48,00	44.47	28,8	52.0	51,5
14	W	9 3,82	13 45,7	41,88	38,34	28,8	53.5	54.0
17	W	8 37.38	13 19,6	41,22	37,68	28,8	57,5	58,0
18	E	11 41,16	6 53,5	46,66	43,11	28,8	51,5	52,7
20	W	8 44.15	13 27,0	41,85	38,31	28,9	57.7	58,5
21	E	10 22,13	5 34,3	46,83	43.30	29,0	59,5	57,6

Observed Zenith Distance of Capella.

Point on the Limb, 4° 50′ South.

May 11	E	10 37,73	10 29,0	4 50 0 8,73	4 50 8,74	28,9	64,0	65,1
12	W	9 16,65	9 18,2	1,55	1,55	28,7	63,5	66,0
13	E	9 42,06	9 34.4	7,66	7,67	28,8	57.4	54.9
15	W	8 38,83	8 39.4	0,57	0,57	28,7	53,0	58,1
June 8	W	8 39.52	8 42,5	2,98	2,98	28,4	63,2	60,1
11	E	9 6,74	8 53,0	12,74	10,54	28,4	65,5	62,5
15	W	10 26,53	10 31,4	4.87	4,88	28,8	78,0	73,0
16	E	8 48,20	8 31,5	16,70	16,73	28,7	72,0	69,5
21	W	12 24.35	12 30.9	6,55	6,56	28,8	71,0	68,5
22	W	5 48,86	5 52,9	4,04	4,05	28,6	86,0	79,1

Operations at the Station near Clifton, the northern Extremity of the Arc, with the Zenith Sector. July and August, 1802.

On the 19th of July, the observatory and zenith sector were erected at the station, and the angle between the spindle of the weathercock on Laughton Spire and a staff at Gringley on

the Hill, was observed on different arches of the large theodolite; the results being as follows, *viz.* 78° 13′ 32″
34
35
32 } Mean 78° 13′ 33″.

In a former article it has been shown, that Gringley is 76° 17′ 25″ south-east of the meridian of Clifton; therefore, 78° 13′ 33″ — 76° 17′ 25″ = 1° 56′ 8″, is the bearing of Laughton Spire from that meridian. The instrument, being otherwise adjusted for observation, was then brought into the plane of it, by setting off 1° 56′ 8″ on the azimuth circle; the permanency of the line of collimation of the lateral telescope having been previously ascertained.

Observations made at Clifton, to determine the Zenith Distance of β Draconis.

Point on the Limb, 1° 0′ South.

Day of the month.	Face of the arch, E. or W.	Plumb-line.	Observation of the star.	Zenith distance in revolutions and parts.	Zenith distance reduced.	Barometer.	Thermometer.	
							Above.	Below.
		rev. div.	rev. div.	° ′ rev. div.	° ′ ″	Inches.	°	°
July 20	W	12 1,04	12 14,8	1 0 0 13,76	1 0 13,78	28,8	58,0	56,0
22	W	7 53,33	13 12,0	17,67	15,52	28,7	54,0	54,5
26	E	13 27,55	13 6,8	20,75	20,78	28,8	64,2	64,3
28	W	9 21,94	9 32,3	10,36	10,38	28,8	59,5	58,5
29	E	9 3,13	8 44,1	18,03	18,06	28,8	56,5	57,5
31	W	9 34.59	9 44,1	9,51	9,52	29,0	57,2	56,5
Aug. 1	E	8 36,00	8 18,5	17,50	17,53	29,2	59,5	57,2
3	W	8 57,87	9 8,9	10,03	10,05	29.16	68,0	64,5
5	E	8 11,26	7 53.8	16,46	16,48	29,0	71,5	73,2
7	W	8 51,74	9 1,6	8,86	8,87	28,9	67,2	66,1
8	E	8 14,84	7 57,9	15,94	15,96	28,9	65,1	65,1
12	E	11 7,98	10 50,6	16,38	16,41	29,15	58,1	58,0
13	W	8 22 00	8 30,4	8,40	8,41	29,3	61,2	61,1
17	E	8 30,33	8 15,8	14,53	14,55	29.1	70,5	71,0
18	W	8 46,62	8 54,7	8,08	8,09	28,8	70,1	70,3

Observed Zenith Distance of γ Draconis.

Point on the Limb, 1° 55′ South.

Day of the month	Face of the arch, E. or W.	Plumb-line	Observation of the star.	Zenith distance in revolutions and parts	Zenith distance reduced.	Barometer.	Thermometer.	
							Above.	Below.
		rev. div.	rev. div.	° ′ rev. div.	° ′ ″	Inches.	°	°
July 20	W	11 49,24	13 12,8	1 55 1 22,56	1 56 21,69	28,9	56,5	55,0
21	E	7 23,81	5 53.7	29,11	28,26	28,5	53,0	52,2
22	W	7 54,31	9 17,1	21,79	20,92	28,7	54,5	54,5
23	E	3 46,15	2 18,9	27.25	26,39	29,0	56,1	56,1
26	W	9 8,47	10 29,5	21,03	20,16	28,8	64,0	64,0
28	E	9 35,56	8 9.6	25,96	25,11	28,8	56,2	57,3
29	W	8 44,41	10 4,5	19,09	19,03	29,0	56,5	56,5
Aug. 1	W	8 41,22	10 3,0	20,78	19.91	29,2	59,5	57,0
3	E	9 7,59	7 40,3	26,29	25,43	29,1	68,0	64,5
5	E	7 50,50	6 25,0	25,50	24.64	29,0	73,0	71,0
7	W	9 7,55	10 24,6	17,05	16,18	28,9	64,2	65,2
12	E	11 7,56	9 42,7	23,86	23,00	29,1	57,5	57,5
13	W	8 12,48	9 29,4	16,92	16,04	29.3	63,0	61,2
17	E	8 10,32	6 46,0	23,32	22.46	29,0	69,5	70,5
18	W	8 32,97	9 48,5	15,53	14,65	28,8	70,0	70,1

Observed Zenith Distance of 45 d Draconis.

Point on the Limb, 3° 25′ North.

July 22	W	7 35,91	6 10,5	3 25 1 25,41	3 25 24,56	28,7	54,0	53,0
26	W	8 36,67	7 11,1	25,57	24,71	28,8	64,6	63,5
29	W	8 53,36	7 26,6	26,86	26,02	28,8	56,5	56,5
31	E	13 50,53	14 51,0	20,47	19,60	29,0	55,0	55,2
Aug. 7	W	8 47,50	7 18,6	28,90	28,04	28,9	65,0	64,0
12	E	11 9,60	12 31,0	21,40	20,53	29,2	55,5	55,5
13	W	8 10,99	6 38,9	31,09	30,24	29,3	60,1	59,1
17	E	8 14,53	9 38,9	24.37	23,51	29,0	71,0	69,5
18	W	8 15,03	6 41,3	32,73	31,88	28,8	—	68,0

Observed Zenith Distance of 46 c Draconis.

Point on the Limb, 1° 55′ North.

Day of the month.	Face of the arch, E. or W.	Plumb-line.	Observation of the star.	Zenith distance in revolutions and parts.	Zenith distance reduced.	Barometer.	Thermometer. Above.	Thermometer. Below
		rev. div.	rev. div.	° ′ rev. div.	° ′ ″	Inches.	°	°
July 20	W	12 7,00	8 55,8	1 50 3 10,20	1 53 7,51	28,9	55,5	55,5
22	W	7 28,12	9 21,4	1 55 1 52,28	8,53	28,7	54,0	53,1
28	E	9 29,68	7 31,3	57,38	3,43	28,8	57,2	55,5
31	E	9 29,77	7 31,7	57,07	7,74	29,0	55,3	55,5
Aug. 3	E	8 55,40	7 0,6	54,80	6,61	29,1	64,0	63,5
5	E	7 11,47	5 15,8	54,67	5,14	29,0	73,5	71,5
7	W	6 37,64	10 26,6	47,96	12,86	28,9	65,2	64,2
12	E	11 3,15	9 9,0	53,15	7,66	29,2	55,5	59,1
13	W	8 6,41	9 52,5	46,09	14,73	29,3	60,0	59,0
17	E	8 25,75	6 32,3	52,45	8,36	29,0	71,2	69,5
18	W	8 20,25	10 6,3	45,05	15,78	28,8	71,0	68,0

Observed Zenith Distance of 51 Draconis.

Point on the Limb, 0° 20′ South.

July 28	E	9 31,75	7 50,7	0 20 1 40,05	0 29 39,21	28,8	55,0	55,0
31	E	9 29,90	7 48,5	40,04	39,56	29,0	55,0	55,5
Aug. 5	E	7 11,71	5 32,6	38,11	37,27	29,0	71,0	69,2
7	W	8 48,70	10 19,5	29,80	28,95	28,9	63,5	63,5
9	W	9 6,30	10 35,3	29,00	28,15	28,9	66,5	65,5
12	E	11 7,00	9 30,5	35,50	34,66	29,2	55,5	59,0
13	W	8 1,71	9 29,5	27,79	26,93	29,3	60,2	59,1
17	E	8 27,62	6 52,0	34,62	33,77	29,0	70,1	70,2
18	W	8 20,96	9 47,4	26,44	25,58	28,8	67,0	67,0

Observed Zenith Distance of μ Draconis.

Point on the Limb, 1° 15′ North.

July 20	W	11 51,87	10 9,3	1 15 1 42,57	1 16 41,73	28,9	58,0	56,0
28	W	9 11,90	7 26,9	44,00	43,17	28,8	58,2	58,5
29	E	9 11,32	10 51,0	39,68	38,84	28,8	56,5	57,5
30	W	9 55,53	8 10,0	45,53	44,70	28,8	59,0	57,5
Aug. 12	E	11 17,11	12 57,3	40,19	39,25	29,15	69,2	65,2
13	W	8 21,48	6 31,5	48,98	48,16	29,32	62,0	63,5

Observed Zenith Distances of 16 Draconis.

Point on the Limb, 0° 5′ South.

Day of the month.	Face of the arch, E. or W.	Plumb-line.	Observation of the star.	Zenith distance in revolutions and parts.	Zenith distance reduced.	Barometer.	Thermometer.	
							Above.	Below.
		rev. div.	rev. div.	° ′ rev. div.	° ′ ″	Inches.	°	°
July 29	E	9 26,41	6 31,7	2 53,71	2 53,99	28,8	59,7	59,5
30	W	9 38,07	12 26,0	46,93	45,20	28,8	62,5	60,1
Aug. 5	E	8 17,70	5 23,0	53,70	51,98	29,1	79,1	78,1

Observed Zenith Distances of 1 ϰ Cygni.

Point on the Limb, 2° 25′ North.

July 20	W	13 45,26	15 42,5	0 25 1 56,24	0 26 55,43	28,9	56,5	55,0
22	W	9 12,66	11 10,3	56,64	55,83	28,7	54,0	54,0
26	W	9 42,42	11 39,1	55,68	54,87	28,8	64,5	63,5
28	E	9 29,47	7 27,2	2 2,27	27 0,47	28,8	55,2	55,2
29	W	9 3,65	11 7,4	3,75	1,95	28,9	56,9	55,0
30	W	9 43,53	11 37,3	1 52,77	26 51,95	28,7	57,0	55,0
31	E	9 30,77	7 28,5	2 2,27	27 0,47	29,0	55,0	55,0
Aug. 5	E	7 8,34	5 9,1	1 58,24	26 57,43	29,0	71,2	69,2
7	W	8 46,45	10 39,0	51,55	50,73	28,9	63,3	63,3
9	W	8 32,50	10 24,6	51,10	50,28	28,9	66,0	65,0
12	E	10 42,00	8 43,0	58,00	57,19	29,2	55,5	59,5
13	W	8 1,11	9 50,9	49,79	48,97	29,3	60,0	59,0
17	E	8 25,55	6 30,2	54,35	53,54	29,0	71,0	69,5
18	W	8 27,85	10 17,0	48,15	47,33	28,8	66,0	66,0

Observed Zenith Distances of 10 ι Cygni.

Point on the Limb, 2° 10′ South.

July 20	W	13 51,27	12 27,2	2 10 1 24,07	2 8 36,79	28,9	56,5	55,0
28	E	9 22,60	10 42,5	19,90	40,97	28,8	57,3	55,5
29	W	9 8,23	7 38,5	28,73	32,12	28,8	56,7	56,5
30	W	9 31,50	8 4,0	27,50	33,36	28,7	55,5	57,5
31	E	9 19,20	10 39,5	20,30	40,57	29,0	55,0	55,2
Aug. 1	W	9 2,40	7 34,1	27,30	33,56	29,2	59,2	57,2
5	E	7 0,70	8 23,2	22,50	38,36	29,0	68,5	68,5
7	W	8 50,33	7 21,5	28,83	32,02	28,9	62,2	63,2
9	W	8 47,48	7 18,0	29,48	31,37	28,9	65,5	66,5
12	E	10 37,36	12 1,0	22,64	38,22	29,2	55,0	59,0
17	E	8 21,50	9 47,0	25,50	35,36	29,0	61,9	68,9
18	W	8 29,25	6 54,7	33,55	27,30	28,8	66,0	66,0

Observed Zenith Distance of γ Ursæ.

Point on the Limb, 1° 20′ North.

Day of the month.	Face of the arch. E. or W.	Plumb-line.	Observation of the star.	Zenith distance in revolutions and parts.	Zenith distance reduced.	Barometer.	Thermometer. Above.	Thermometer. Below.
		rev. div.	rev. div.	° ′ rev. div.	° ′ ″	Inches.	°	°
Aug. 17	E	8 58,45	9 9,9	1 20 0 10,45	1 20 10,42	29,3	89,0	83,6

Observed Zenith Distances of η Ursæ.

Point on the Limb, 3° 5′ South.

July 23	W	9 1,35	13 5,0	3 5 4 3,65	3 9 0,05	29,0	62,5	62,5
26	W	9 26,00	13 30,9	4,90	1,30	28,9	78,0	78,2
Aug. 4	W	8 40,50	12 46,0	5,50	1,90	29,2	79,3	79,5
8	E	7 34,74	3 22,0	17,74	9,15	29,0	76,0	73,0
17	E	8 52,05	4 38,5	13,45	9,86	29,14	88,0	81,5

Observed Zenith Distances of ζ Ursæ.

Point on the Limb, 2° 30′ North.

July 29	E	9 8,82	9 21,5	2 30 0 12,68	2 30 12,70	28,8	69,0	65,5
Aug. 5	W	8 40,97	8 22,5	18,47	18,50	29,1	79,5	78,0
8	E	8 25,15	8 37,0	11,83	11,87	29,0	69,0	65,5
9	W	8 49,00	8 29,4	14,60	19,62	28,9	80,0	80,0
17	E	9 10,43	9 22,0	11,57	11,59	29,4	85,1	80,1

Observed Zenith Distances of 85 ι Herculis.

Point on the Limb, 7° 20′ South.

July 20	W	11 50,28	12 6,0	7 20 0 14,72	7 20 14,74	28,9	55,5	55,5
23	E	3 50,07	3 28,5	11,57	21,60	29,0	56,1	56,1
28	W	9 30,92	14 47,4	15 5 16,48	12,00	28,8	56,0	57,0
30	W	10 15,40	10 26,5	20 0 11,10	11,12	29,0	57,1	56,2
Aug. 1	W	9 6,18	9 17,0	10,82	10,84	29,2	59,5	57,2
5	E	8 2,52	7 42,0	19,52	19,75	29,0	73,0	71,0
7	W	9 17,54	9 29,0	11,46	11,48	28,9	67,2	66,1
17	E	8 15,52	7 56,0	18,52	18,55	29,0	70,5	71,2

Observed Zenith Distances of υ Herculis.

Point on the Limb, 6° 50′ South.

Day of the month.	Face of the arch, E. or W.	Plumb-line.	Observation of the star.	Zenith distance in revolutions and parts.	Zenith distance reduced.	Barometer.	Thermometer.	
							Above.	Below.
		rev. div.	rev. div.	° ′ rev. div.	° ′ ″	Inches.	°	°
July 21	E	8 11,5	6 16,6	6 50 1 53,7	6 51 52,89	28,5	55,5	54,5
29	E	9 14,1	7 17,0	56,1	55,29	28,8	60,7	61,5
30	W	7 57,8	9 48,8	46,0	47,17	28,8	62,5	60,0

Observed Zenith Distances of 52 Herculis.

Point on the Limb, 7° 5′ South.

July 28	W	8 58,72	11 15,5	7 5 2 15,78	7 7 14,00	28,8	58,5	58,5
29	E	9 11,35	6 47,0	23,35	21,58	28,8	59,7	59,5
30	W	10 1,29	12 16,0	14,71	12,93	28,8	61,0	59,0
Aug. 8	E	8 50,70	6 23,9	26,80	25,04	28,9	65,2	65,5

Observed Zenith Distances of 22 τ Herculis.

Point on the Limb, 6° 40′ South.

July 29	E	3 56,30	3 57,9	6 40 0 1,60	6 39 59,40	28,8	60,7	61,5
30	W	8 8,81	7 58,6	9,21	50,77	28,8	62,5	60,0
Aug. 1	W	8 5,20	7 53,1	11,10	48,88	29,2	67,0	67,0
7	W	10 1,73	9 50,5	10,23	49,75	28,9	71,0	69,0
12	W	10 16,30	10 4,0	12,50	47,48	29,2	65,2	63,3
13	E	8 12,30	8 16,8	4,50	55,49	29,3	67,3	66,5

Observed Zenith Distances of α Persei.

Point on the Limb, 4° 20′ South.

Aug. 8	W	9 7,66	7 45,7	4 20 1 20,96	4 18 39,91	28,9	66,5	63,0
10	W	8 38,84	7 18,0	20,84	40,03	28,9	70,2	71,0
13	E	10 27,76	11 45,6	17,84	43,03	29,3	57,0	54,0
18	E	8 26,58	9 43,5	16,92	43,95	29,0	60,2	60,2
19	W	8 11,42	6 47,5	22,92	37,94	28,8	60,5	60,3

Observed Zenith Distances of Capella.

Point on the Limb, 7° 40′ South.

Day of the month.	Face of the arch, E. or W.	Plumb-line.	Observation of the star.	Zenith distance in revolutions and parts.	Zenith distance reduced.	Barometer.	Thermometer.	
							Above.	Below.
		rev. div.	rev. div.	° ′ rev. div.	° ′ ″	Inches.	°	°
Aug. 7	W	9 7,20	9 36,0	7 40 0 28,80	7 40 22,85	28,7	66,0	66,0
8	E	9 5,23	8 25,7	38,53	38,59	28,9	71,5	71,0
9	E	6 28,62	5 48,0	39,62	39,68	28,9	81,5	74,5
18	W	9 1,45	9 26,9	25,45	25,49	29,0	74,0	68,0
19	E	8 3,80	7 28,0	34,80	34,86	28,8	68,7	67,5

Operations at the new Station on Arbury Hill, near Daventry, with the Zenith Sector, in the Months of September and October, 1802.

In the Phil. Trans. for 1800, page 658, it will be seen, that the bearing of the Summer House on Bardon Hill, in the north of Leicestershire, from the meridian of Arbury Hill, is 7° 37′ 31″ NW; and, as this spot is only 2776 feet westward from the meridian of Dunnose itself, it follows, that 7° 37′ 31″ may be taken for the bearing of the above object from Arbury Hill. To avoid, however, the possibility of any error arising from adopting this supposition, the direction of the meridian was ascertained, (before the zenith sector was got up,) by a double azimuth of the pole star. From this it appeared, that the angular point of the roof of a house about seven miles distant, was within a few seconds of the true northern direction; and also, that Bardon Hill (the summer house) was 7° 37′ 35″ north-west. By observing these two objects, as the weather suited, the sector was afterwards got into the plane of the meridian.

Observations made on Arbury Hill, to determine the Zenith Distance of β Draconis.

Point on the Limb, 0° 15′ North.

Day of the month.	Face of the arch, E. or W.	Plumb-line.	Observation of the star.	Zenith distance in revolutions and parts.	Zenith distance reduced.	Barometer.	Thermometer.	
							Above.	Below.
		rev. div.	rev. div.	° ′ rev. div.	° ′ ″	Inches.	°	°
Sept. 8	W	9 48,90	10 54,7	0 15 1 5,80	0 13 55,09	28,2	51,0	54,0
18	E	9 37,98	8 26,5	11,48	49.40	28,8	70,5	72,5
19	W	9 17,78	10 23,0	5,22	55,67	28,8	71,5	76,5
20	E	9 16.33	8 6,5	9,83	51,06	28,8	68,2	69,0
22	E	9 26,17	8 16,0	10,17	50,71	28,8	79.3	75.3
23	W	8 21,00	9 25,0	4,00	56,89	28,9	76,5	76,5
24	E	9 7,68	7 57,0	9,68	51,21	28,9	71,0	70,5
25	W	9 29,13	10 34,0	4,87	56,02	29.1	74.5	75.5
26	E	9 4,27	7 51,8	11,47	49.41	29,0	64.5	66,5
28	W	10 43,25	11 48,7	5.45	55.45	29,0	65,5	65,5
29	E	9 27,65	8 17,3	10,35	50,53	29,1	79,0	77.5
30	W	9 25,82	10 30,7	4,88	56,04	29,0	64,0	69,5
Oct. 1	E	9 43,20	8 31,0	12,20	48,79	29,0	72,2	71,5
3	W	9 19,02	10 26,6	7.58	53.31	28,7	74,0	73,0

Observed Zenith Distances of γ Draconis.

Point on the Limb, 0° 40′ South.

Sept. 10	W	8 53,85	11 6,4	0 40 2 11,55	0 42 9,76	28,2	51,5	54,0
11	E	8 47,75	6 31,9	15,85	14,07	28,53	48,2	55,0
18	E	9 46,65	7 28,7	17,95	16,17	28,8	70,3	72,3
19	W	9 18,90	11 31,5	12,60	10,82	28,8	67,5	73.5
20	E	9 1,78	6 42,8	17,98	16,20	28,8	68,3	71,4
22	E	9 16,52	6 58,2	17,32	15,54	28,8	79,8	75,8
23	W	8 9,97	10 20,5	10,53	8,74	28,8	67,5	65,3
24	E	9 16,97	7 0,8	16,17	14.39	28,9	70,5	70,2
25	W	9 16,00	11 27,6	11,60	9,81	29,1	74,0	75,2
26	W	9 10,47	11 23,0	12,53	10,75	29,0	59.5	64,2
29	E	9 17.50	7 0,8	16,70	14,92	29,1	64,0	69,5
30	W	9 21,63	11 33.5	11,87	10,08	29,9	64,0	69,5
Oct. 1	E	9 34.95	7 15.5	19,45	17,87	28,9	72,5	71,9
2	E	9 25,33	7 7,0	18,33	16,57	28,8	71,0	75,0
3	W	8 54.30	11 7,1	11,80	10,01	28,6	74,0	73,0

Observed Zenith Distances of 45 d Draconis.

Point on the Limb, 4° 40′ North.

Day of the month.		Face of the arch, E. or W.	Plumb-line.	Observation of the star.	Zenith distance in revolutions and parts.	Zenith distance reduced.	Barometer.	Thermometer. Above.	Thermometer. Below.
			rev. div.	rev. div.	° ′ rev. div.	° ′ ″	Inches.	°	°
Sept.	8	W	9 57.57	9 21,1	4 40 0 36.47	4 40 38,53	28,2	52,0	54.0
	15	W	7 29,48	6 47.3	40,98	41,05	28,9	63.5	66,0
	18	E	9 45.55	10 18,6	32,05	32,10	28,8	64,2	67,2
	19	W	9 28,10	8 46,6	40,50	40,57	28,8	66,5	72,5
	20	E	8 56,23	9 29,1	31,87	31,92	28,8	66,5	69,5
	23	W	8 0,83	7 22,4	37.43	37.49	28,8	67.5	65.5
	24	E	9 18,78	9 50,4	31,62	31,67	28,9	65.5	63.5
	25	W	9 36,25	8 57,1	38,15	38,21	29,0	65,3	67,3
	26	E	9 14,12	9 46,5	32,37	32,42	29,0	64,8	66,5
	28	E	9 18,62	9 50,0	31,38	31,43	29,0	65,3	64,5
	29	W	8 57.55	8 20,0	37.55	37,61	29,1	64,5	69,0
	30	W	8 51,62	8 13,5	37,12	38,18	29,0	64,3	69,8
Oct.	1	E	9 25,05	14 58,7	33,65	29,20	28,9	72.0	71,5
	2	E	9 18,35	9 50,6	32,35	32,40	28,8	72,5	75.5

Observed Zenith Distances of 46 c Draconis.

Point on the Limb, 3° 5′ North.

Sept.	7	E	9 3,63	11 19,23	3 5 2 15,40	3 7 13,62	28,5	63,0	64,5
	10	E	9 3.73	11 19,4	15,67	13,89	28,2	51,0	54,0
	15	W	7 30,08	5 6,5	23,58	21,85	28,9	63,5	66,0
	16	W	10 22,70	7 55.9	24,80	23,04	29,0	61,5	65,5
	18	E	9 29,12	11 47,0	17,88	16,11	28,8	64,0	67,0
	19	W	9 40,57	7 16,3	24,27	22,51	28,8	66,5	72,0
	20	E	8 34,27	10 52,3	18,03	16,26	28,8	66,0	69,0
	21	W	9 55.90	7 29,0	26,90	25,14	28,8	66,5	69,5
	22	E	8 2,67	11 20,4	17.73	15.95	28,8	79,2	75.3
	23	W	9 20,01	6 45,0	24,10	22,34	28,8	67,5	65,0
	24	E	9 3.97	11 22,3	18,33	16,56	28,8	65,5	63,0
	25	W	9 42,55	7 19,2	23.35	21,58	29,0	65,5	67,3
	26	E	9 9,10	11 27,0	17,90	16,12	29,0	64,5	66,5
	28	E	9 17,52	11 35,0	17,48	15,70	29,0	65,5	64,5
	29	W	9 13,00	7 48,4	23,60	21,83	29,0	64.5	69,0
	30	W	9 4,20	6 38,8	24,40	22,64	29,1	64,5	69,5
Oct.	1	E	9 18,65	11 36,1	17.45	15,67	29,0	68,2	61,4
	2	E	9 22,35	14 41,1	18,75	16,97	28,8	68,0	70,5

Observed Zenith Distances of 1 κ Cygni.

Point on the Limb, 0° 45′ North.

Day of the month.	Face of the arch, E. or W.	Plumb-line.	Observation of the star.	Zenith distance in revolutions and parts.	Zenith distance reduced.	Barometer.	Thermometer. Above.	Thermometer. Below.
		rev. div.	rev. div.	° ′ rev. div.	° ′ ″	Inches.	°	°
Sept. 7	E	8 12.72	10 25,2	0 45 2 12,48	0 47 10,69	28,2	51,0	54,0
8	W	6 54,92	4 36,0	18,92	17,15	28.2	51,5	54,5
15	W	8 52,42	6 31,5	20,92	19,15	28,9	62,5	65,3
16	W	10 31,57	8 9,0	22,57	20,80	28,9	61,0	65,0
18	E	8 21,80	10 38,0	16,20	14,42	28,8	64.3	67,5
19	W	9 37,03	7 14,5	22,53	20,77	28,8	66,5	72,0
20	E	8 24,05	15 43,6	40 7 19,55	13,27	28,8	65,0	67,0
22	E	8 50,82	11 9,0	45 2 17,18	15,40	28,8	66,3	66,5
23	W	8 56,10	6 33,5	22,60	20,83	28,8	67,5	65,3
24	E	8 32,52	10 48,5	15,98	14,20	28,9	59.3	63,5
25	W	9 44,57	7 23,5	21,07	19,30	29,0	66,5	67,0
26	E	9 20,58	11 36,0	15,42	13,64	29,0	64,5	66,5
28	E	9 31,90	11 47,7	15,80	14,02	29,0	60,5	62,5
29	W	9 58,00	7 35,0	23,00	21,23	29,0	64,5	68,0
30	W	9 48,10	7 24,9	23,20	21.43	29,0	62,0	65,5
Oct. 1	E	9 9,42	11 26,0	16,58	14,80	28,9	64,0	66,5
2	E	9 21,82	11 38,0	16,18	14,40	28,0	65,0	68,0

Observed Zenith Distances of 51 Draconis.

Point on the Limb, 0° 50′ North.

Sept. 7	E	8 13,88	5 43,5	0 55 2 29,38	0 52 32,37	28,2	51,5	54,5
8	W	6 41,63	4 1,5	0 50 2 49.13	38,39	28,2	51,0	54,0
10	E	9 16,00	11 53,7	37,70	35,96	28,2	51,0	54,0
16	W	10 39,00	7 55,5	42,50	40,77	29,0	61,7	65,5
18	E	8 42,00	11 19,7	36,70	34,96	28,8	64,0	67,2
19	W	9 56,73	7 13,6	43,13	41,42	28,8	66,5	72,0
20	E	8 26,10	11 13,0	35,90	34,15	28,8	66,5	69,5
22	E	8 54,28	11 31,2	35,92	34,17	28,8	68,5	63,0
23	W	9 4,53	6 21,9	41,63	39.89	28.8	67.5	65,5
25	W	9 34.53	6 51,5	42,03	40,30	29,0	67,0	67,0
26	E	9 24.17	12 1,4	36,23	34.49	29,0	59,5	64,5
28	E	9 30,17	12 7,3	36,13	34,39	29,0	66.0	64,0
29	W	9 17,85	6 53,9	40,95	39.21	29.0	65,5	69,5
30	W	9 35,83	6 51,0	43,83	42,10	29.0	64,0	70,3
Oct. 1	E	9 11,55	11 49,0	37.45	35.71	29,0	68.0	68,0
2	E	9 24,62	11 2,4	36,78	35,04	28,8	68,0	70,5

Observed Zenith Distance of 10 ι *Cygni.*

Point on the Limb, 0° 55′ *South.*

Day of the month.	Face of the arch, E. or W.	Plumb-line.	Observation of the star.	Zenith distance in revolutions and parts.	Zenith distance reduced.	Barometer.	Thermometer.	
							Above.	Below.
		rev. div.	rev. div.	° ′ rev. div.	° ′ ″	Inches.	°	°
Sept. 18	E	8 19,17	8 53,6	0 55 0 34,43	0 54 25,51	28,8	64,5	67,5
19	W	9 37,65	9 2,2	35,45	20,49	28,8	66,5	72,0
20	E	8 31,87	9 7,5	34.63	25,31	28,8	65,0	67,0
21	W	10 16,65	9 35,3	40,35	19,58	28,8	65,2	67,2
22	E	8 51,59	9 28,2	35,61	24,33	28,8	66,0	66,0
23	W	8 49,25	8 10,5	38,75	21,19	28,8	65,5	65,5
24	E	8 22,08	8 56,0	33.91	26.02	28,8	59,0	63,0
25	W	9 45,92	9 7,0	38,92	21,02	29,0	66,5	67,0
26	E	9 11.63	9 46,4	34,77	25,17	29,0	59,0	64,0
27	W	8 57,40	8 13,4	44,00	19.93	29,0	52,0	55,5
28	E	8 54,83	9 31,1	35.27	24,67	29,0	60,0	62,0
29	W	9 52,90	9 12,0	40.90	19,03	29,0	64.5	68,0
30	W	9 53,38	9 11,3	42,08	17,85	29,0	62,0	65,0
Oct. 1	E	9 10,95	9 47,0	36,05	23,89	28,9	64,0	66,5
2	E	9 23,18	10 0,3	36,12	23,82	28,8	68,5	65,5

Observed Zenith Distances of γ *Ursæ.*

Point on the Limb, 2° 35′ *North.*

Sept. 18	E	9 32,47	8 34,9	2 35 0 56,57	2 34 3,33	28,8	77,5	76,5
23	W	8 20,07	9 20,1	2 35 0 57,03	2,87	28,9	80,0	76,0
26	W	9 22,70	10 18,5	54,80	5,10	29.1	80,5	75,0
Oct. 3	E	9 10,45	8 2,5	1 7,95	33 52,94	28,7	72,8	78,5

Observed Zenith Distances of η *Ursæ.*

Point on the Limb, 1° 55′ *South.*

Sept. 10	W	8 16.58	8 24.4	1 55 0 7,82	1 55 7,83	28,1	63,0	64,5
20	E	9 26.02	9 13,9	12.12	12,14	28,8	84,5	80,5
23	W	8 4,60	8 14,1	9 50	9,51	28,9	84,0	82,5
24	E	8 50,25	8 34,5	15,75	15,77	28.9	79,0	75,0
25	W	9 21,40	9 33.5	12 10	12,12	29,0	82,8	80,5
26	E	8 54,63	8 36,6	18 03	18,06	29,1	80,0	77,0
28	E	10 5,25	9 47.7	16 55	16.57	29,1	78,5	72,5
30	W	10 6.12	10 15,0	8 88	8.89	29,1	84,0	76,0
Oct, 3	E	9 27,63	9 9,2	18,43	18,46	29,0	80,0	76,2

Observed Zenith Distances of ζ Ursæ.

Point on the Limb, 3° 45′ North.

Day of the month.	Face of the arch, E. or W.	Plumb-line.	Observation of the star.	Zenith distance in revolutions and parts.	Zenith distance reduced.	Barometer.	Thermometer. Above.	Thermometer. Below.
		rev. div.	rev. div.	° ′ rev. div.	° ′ ″	Inches.	°	°
Sept. 24	E	8 40,70	7 44,4	3 45 0 55,60	3 44 4,31	28,9	79,5	75,5
26	W	9 1,95	9 53,5	51,55	8,36	29,1	80,0	77,5
30	E	9 50,72	8 50,0	1 0,72	0,18	29,0	84,0	76,0
Oct. 3	E	7 3,00	6 1,9	1 1,10	43 59,80	28,7	80,5	75,5

Observed Zenith Distances of 22 τ Herculis.

Point on the Limb, 5° 15′ South.

Sept. 18	E	9 50,42	8 52,5	5 25 0 56,92	5 25 57,01	28,8	72,5	74,5
Oct. 3	W	9 33,10	10 24,5	50,40	50,48	28,6	76,5	76,0

Observed Zenith Distances of α Persei.

Point on the Limb, 3° 5′ South.

Sept. 8	E	7 35,23	8 0,6	3 5 0 23,37	3 4 36,59	28,8	41,0	44,0
12	E	8 29,27	8 52,5	23,23	36,73	28,8	41,5	44,5
16	W	9 17,50	8 47,9	28,60	31,35	28,9	55,7	57,5
18	W	9 53,52	9 25,3	28,22	31,73	28,8	57,2	58,5
19	E	7 52,87	8 11,0	23,13	36,83	28,8	53,5	58,0
22	E	7 44,73	8 9,3	23,57	36,39	28,8	58,0	62,0
23	W	8 58,00	8 27,4	30,60	29,35	28,7	60,0	60,0
25	E	8 58,42	9 23,7	24,28	35,67	29,0	49,5	53,5
26	W	9 49,10	9 19,8	29,30	30,65	29,1	55,5	54,3

Observed Zenith Distances of Capella.

Point on the Limb, 7° 40′ South.

Day of the month.	Face of the arch, E. or W.	Plumb-line.	Observation of the star.	Zenith distance in revolutions and parts.	Zenith distance reduced.	Barometer.	Thermometer.	
							Above.	Below.
		rev. div.	rev. div.	° ′ rev. div.	° ′ ″	Inches.	°	°
Sept. 11	E	9 47,77	8 15,9	6 25 1 33,87	6 26 33,02	28,8	46.5	50,5
12	E	8 45,17	7 12,1	34,07	32,22	28,7	38,5	43,5
14	W	7 41,57	9 9,1	26,53	25,67	28,8	53,5	56,5
16	W	9 51,50	10 20,3	27,80	26,94	28,9	54.5	56,5
18	E	9 24,77	7 48,8	34,97	34,12	28,9	55,0	58,0
19	W	8 10,88	9 38,0	27,52	26,66	28,9	56,0	57,5
20	E	8 48,20	7 15,2	33,00	32,15	28,8	57,2	59,1
21	W	8 16,97	9 45,5	28,53	27,67	28,8	54,0	56,5
22	E	9 6,93	7 34,0	31,93	31,08	28,8	58,0	62,0
23	W	8 48,50	10 16,2	26,70	25,84	28,7	60,5	58,5
25	E	8 53,40	7 20,0	33,30	32,45	29,0	48,5	48,5
26	W	9 49,52	11 18,6	28,08	27,22	29,1	55,0	56,5

Operations at the Royal Observatory with the Zenith Sector.

April, 1802.

Observed Zenith Distances of β Draconis.

Point on the Limb, 0° 55′ North.

April 16	W	9 57,80	6 44,2	0 55 3 13,60	0 58 10,92	29,9	40,0	40,0
23	E	8 35,49	11 40,9	5,41	2,71	30,1	38,0	38,0
25	W	10 7,84	6 53,0	13,84	11,16	29.8	44,0	44,0
26	W	9 24,63	6 11,5	13,13	10,45	29,5	42,0	42,0

Observed Zenith Distances of γ Draconis.

Point on the Limb, 0° 0′ North.

April 16	W	10 21,73	8 18,5	0 0 2 3,23	0 2 1,43	29,9	45,0
19	W	9 9,40	7 4,1	5,30	3,50	31,1	53
22	E	8 14,48	10 9,5	1 54,02	1 53,21	29,9	55
23	E	9 21,79	10 18,5	55,71	54,90	30,1	38
25	W	9 39,52	7 34,4	2 5,12	2 3,32	29	44

Observed Zenith Distances of 45 Draconis.

Point on the Limb, 5° 20′ North.

Day of the month.	Face of the arch, E. or W.	Plumb-line.	Observation of the star.	Zenith distance in revolutions and parts.	Zenith distance reduced.	Barometer. Above.	Thermometer. Below.
		rev. div.	rev. div.	° ′ rev. div.	° ′ ″	Inches.	°
April 19	W	9 38,57	4 46,5	5 20 4 51,07	5 24 47,48	31,1	53
23	E	8 21,37	13 6,0	43,63	40,01	30,1	38
25	W	9 47,20	4 54,5	51,70	48,19	29,8	40

Observed Zenith Distance of 46 c Draconis.

Point on the Limb, 3° 50′ North.

April 15	W	9 15,70	7 41,9	3 50 1 32,80	3 51 31,95	29,8	44

Observed Zenith Distance of 51 Draconis.

Point on the Limb, 1° 36′ North.

April 19	W	9 48,80	8 55,7	1 35 0 52,10	1 35 52,19	31,1	53
23	E	8 43,56	10 27,8	43,34	43,31	30,1	38
25	W	8 54,53	7 46,0	49,83	49,91	29,8	44

Observed Zenith Distance of 1 κ Cygni.

Point on the Limb, 1° 30′ North.

April 23	E	9 20,36	10 42,8	1 30 1 22,44	1 31 21,53	30,1	38
25	W	8 29,76	6 58,6	30,16	29,31	29,5	51

Observed Zenith Distance of 10 ι Cygni.

Point on the Limb, 0° 10′ South.

April 19	W	11 32,42	11 42,6	0 10 0 10,18	0 10 10,19		
23	E	9 36,12		18,42	18,45		

Observed Zenith Distance of γ Ursæ.

Point on the Limb, 3° 15′ North.

Day of the month.	Face of the arch, E. or W.	Plumb-line.	Observation of the star.	Zenith distance in revolutions and parts.	Zenith distance rectified.	Barometer. Above.	Thermometer. Below.
		rev. div.	rev. div.	° ′ rev. div.	° ′ ″	Inches.	°
April 20	E	8 44,30	12 42,7	3 15 3 58,40	3 18 55,79	29,9	50
22	E	10 36,00	14 36,0	4 0,00	56,39	29,9	50
23	E	4 28,25	8 29,5	0,75	57,14	30,1	48
24	W	9 36,90	5 25,1	11,80	19 8,21	29,8	47

Observed Zenith Distance of η Ursæ.

Point on the Limb, 1° 10′ South.

April 16	W	10 13,90	10 40,7	1 10 0 26,80	1 10 26,84	29,9	45
23	E	3 37,50	3 4,6	32,40	32,45	30,1	38

Observed Zenith Distance of 85 ι Herculis.

Point on the Limb, 5° 20′ South.

April 16	W	11 1,59	11 47,9	5 20 0 46,31	5 20 46,39	29,0	40
19	W	9 40,30	10 30,5	39,26	39,26	31,5	53
23	E	9 21,16	9 23,5	56,66	56,75	30,1	38

Table showing the Runs of the Micrometer-screw over every 5′ in the first Degree on each Side of Zero.

Right Hand Arc.

	°	′	R.	D.	R.	D.
At	0	0	8	55,43	5	4,45
	0	5	14	0,88		
	0	5	9	32,55	5	4,55
	0	10	14	37,10		
	0	10	9	40,03	5	4,34
	0	15	14	44,37		
	0	15	9	19,13	5	4,45
	0	20	14	23,58		
	0	20	9	54,07	5	4,40
	0	25	14	58,47		
	0	25	9	39,23	5	4,41
	0	30	14	43,64		
	0	30	9	25,77	5	4,44
	0	35	14	30,21		
	0	35	9	58,53	5	4,54
	0	40	15	4,07		
	0	40	9	0,53	5	4,54
	0	45	14	5,07		
	0	45	9	12,47	5	4,55
	0	50	14	17,02		
	0	50	9	43,07	5	4,43
	0	55	14	47,50		
	0	55	8	41,27	5	4,50
	1	0	13	45,77		

Left Hand Arc.

	°	′	R.	D.	R.	D.
At	0	0	9	16,31	5	4,54
	0	5	4	11,77		
	0	5	9	8,73	5	4,56
	0	10	4	4,17		
	0	10	8	53,67	5	4,50
	0	15	3	49,17		
	0	15	9	16,13	5	4,44
	0	20	4	11,69		
	0	20	9	17,50	5	4,53
	0	25	4	12,97		
	0	25	10	4,30	5	4,50
	0	30	4	58,80		
	0	30	8	52,0	5	4,47
	0	35	3	47,53		
	0	35	9	7,83	5	4,53
	0	40	4	3,30		
	0	40	9	3,31	5	4,41
	0	45	3	57,90		
	0	45	9	12,63	5	4,40
	0	50	4	8,23		
	0	50	9	4,50	5	4,47
	0	55	4	0,03		
	0	55	8	35,0	5	4,57
	1	0	3	30,43		

Table for converting the Divisions shewn on the Micrometer Head into Seconds; the Space subtended by 5′ on the Limb being found = 5 Revolutions 45 Divisions, as deduced from the Measurement of the Total Arches.

R.	D.	″	R.	D.	″
0	1	1,002	0	30	30,050
0	2	2,003	0	31	31,052
0	3	3,005	0	32	32,053
0	4	4,007	0	33	33,055
0	5	5,008	0	34	34,057
0	6	6,010	0	35	35,058
0	7	7,012	0	36	36,060
0	8	8,013	0	37	37,062
0	9	9,015	0	38	38,063
0	10	10,016	0	39	39,065
0	11	11,018	0	40	40,067
0	12	12,020	0	41	41,068
0	13	13,022	0	42	42,170
0	14	14,023	0	43	43,072
0	15	15,025	0	44	44,073
0	16	16,027	0	45	45,075
0	17	17,028	0	46	46,077
0	18	18,030	0	47	47,078
0	19	19,032	0	48	48,080
0	20	20,033	0	49	49,082
0	21	21,035	0	50	50,083
0	22	22,037	0	51	51,085
0	23	23,038	0	52	52,087
0	24	24,040	0	53	53,088
0	25	25,042	0	54	54,090
0	26	26,043	0	55	55,092
0	27	27,045	0	56	56,093
0	28	28,047	0	57	57,095
0	29	29,043	0	58	58,097

Table for supplying the necessary Correction to the observed Zenith Distance of a Star, on account of the Expansion or Contraction of the sectorial Tube by 1° of Heat.

Zenith distance observed.	Correction for 1° of heat.
° ′	″
1 —	0,018
1 30 —	0,028
2 —	0,037
2 30 —	0,046
3 —	0,056
3 30 —	0,065
4 —	0,074
4 30 —	0,084
5 —	0,093
5 30 —	0,102
6 —	0,111
6 30 —	0,121
7 —	0,130
7 30 —	0,129

In using the above Table, the corrections are to be taken as negative, if the upper thermometer denotes the air to be hotter towards the top of the observatory than round the limb of the sector; and positive, if the reverse.

Reduction of the several Observations contained in the preceding Article, from the respective Days on which they were made, to the first of January, 1802; *the Equations being those for Aberration, Nutation, semi-annual solar Equation, Precession, and Refraction; with the Zenith Distances of the several Stars deduced therefrom.*

Reduction of the Observations made at Dunnose.

β *Draconis, N.*

Face of limb, West.		Face of limb, East.			
May 11—1° 50′	7″,65	May 13—1° 50′	0″,23	Zenith dist. 1° 50′ 3″,46	
14	7,0	16	1,10	+1,83	Mean refraction.
June 5	6,11	June 8	0,12	—0,05	Temperature.
				+0,00	Expansion of axis.
11	6,99	13	0,55	Mean zen. dist. 1 50 5,24.	
14	5,87	16	0,01	Line of collimation 3,42.	
17	6,32	18	49 58,59		
20	7,43	21	0,68		
Mean 1 50	6,88	Mean 1 50	0,04		

γ *Draconis, N.*

May 11—0° 54′	0″,34	May 10—0° 53′	51″,66	Zenith dist. 0° 53′ 55″,75	
14	0,12	13	52,31	+ 0,91	Refraction.
June 11	53 59,45	16	51,54	— 0,02	Temperature.
				— 0,01	Expansion of axis.
14	59,14	June 13	51,53	Mean zen. dist. 0 53 56,63.	
17	59,44	17	53,58	Line of collimation 3,64.	
20	57,83	18	51,11		
		21	53,07		
Mean 0 53	59,39	Mean 0 53	52,11		

45 *d Draconis, N.*

June 14—6° 16′	45″,24	June 13—6° 16′	36″,66	Zenith dist. 6° 16′ 41″,70	
18	47,41	16	37,91	+ 6,29	Refraction.
21	45,99	20	37,47	— 0,21	Temperature.
				— 0,12	Expansion of axis.
Mean 6 16	46,21	Mean 6 16	37,29	Mean zen. dist. 6 16 47,66.	
				Line of collimation 4,46.	

46 *c Draconis, N.*

June 14—4° 43′	29″,43	June 13—4° 43′	20″,76	Zenith dist. 4° 43′ 24″,42 + 4″,71 (refr. &c.) = 4° 43′ 28″,93
18	26.06	16	19,99	Line of collimation 3,41.
21	28,09	28	22,18	
Mean 4 43	27,86	Mean 4 43	20,98	

51 *Draconis, N.*

Face of limb, West.	Face of limb, East.
June 14—2° 28′ 45″,62	June 13—2° 28′ 38″,26
18 44,85	10 37,67
21 44,85	20 39,01
Mean 2 28 45,11	Mean 2 28 38,31

Zenith dist. 2° 28′ 41″,71+2″,34 (refr. &c.)=2° 28′ 44″,05.
Line of collimation 3,40.

μ *Draconis, N.*

May 11—4° 7′ 1″,57	May 13—4° 6′ 51″,29
14 6 57,63	June 8 51,58
June 14 59,13	13 51,00
17 58,18	16 51,12
20 58,43	18 52,20
	21 52,57
Mean 4 6 58,99	Mean 4 6 51,62

Zenith dist. 4° 6′ 55″,30+4″, (refr. &c.)=4° 6′ 59″,30.
Line of collimation 3,68.

16 *Draconis, N.*

May 11—2° 42′ 34″,99	June 13—2° 42′ 26″,55
14 34,17	16 27,73
16 33,27	18 26,85
June 11 34,25	
14 34,26	
20 34,31	
Mean 2 42 34,21	Mean 2 42 27,04

Zenith dist. 2° 42′ 30″,63+2″,63 (refr. &c.)=2° 42′ 33″,26.
Line of collimation 3,58.

1 κ *Cygni, N.*

June 14—2° 23′ 26″,44	June 13—2° 23′ 16″,46
18 23,20	16 16,54
21 20,51	20 17,31
Mean 2 23 24,38	Mean 2 23 16,77

Zenith dist. 2° 23′ 20″,58+2″,28 (refr. &c.)=2° 23′ 22″,86.
Line of collimation 3,80.

10 ι *Cygni, N.*

June 14—0° 41′ 43″,52	June 13—0° 41′ 35″,84
18 43,53	16 36,42
21 42,69	20 38,54
Mean 0 41 43,24	Mean 0 41 36,93

Zenith dist. 0° 41′ 40″,08+0″,68 (refr. &c.)=0° 41′ 40″,68.
Line of collimation 3,15.

γ *Ursæ, N.*

May 11—4° 10′ 33″,47	May 9—4° 10′ 28″,18
15 36,73	10 28,58
June 5 36,65	13 29,82
13 35,75	14 29,02
14 34,80	17 30,01
	20 29,42
	June 8 30,24
	16 30,24
Mean 4 10 35,48	Mean 4 10 29,44

Zenith dist 4° 10′ 32″,46+3″,77 (refr. &c.)=4° 10′ 36″,23.
Line of collimation 3,02.

η *Ursæ, S.*

Face of limb, West.		Face of limb, East.	
May 14—0° 18′	38″,84	May 10—0° 18′	44″,08
16	40,16	13	45,86
June 5	39,64	15	46,11
11	37,13	17	45,01
13	38,62	June 8	47,04
16	42,06	12	46,57
18	39,89	14	45,21
		20	46,18
		21	43,78
Mean 0 18	39,48	Mean 0 18	45,54

Zenith dist. 0° 18′ 42″,61 + 0″,32 (refr. &c.) = 0°
Line of collimation 3,06.

ζ *Ursæ, N.*

May 11—5° 20′	34″,10	May 13—5° 20′	26″,41
June 5	34,15	17	28,46
11	34,42	June 8	25,28
18	34,57	14	26,96
		17	26,38
		20	27,14
Mean 5 20	34,30	Mean 5 20	26,77

Zenith dist. 5° 20′ 30″,53 + 5″,13 (refr. &c.) = 5° 2
Line of collimation 3,76.

85 ι *Herculis, S.*

May 14—4° 29′	54″,76	May 10—4° 30′	0″,16
June 14	53,20	13	1,39
		16	1,18
Mean 4 29	53,98	Mean 4 30	0,91

Zenith dist. 4° 29′ 57″,48 + 4″,47 (refr. &c.) = 4° 3
Line of collimation 3,46.

υ *Herculis, S.*

May 14—4° 1′	25″,29	May 13—4° 1′	33″,50
16	26,46	June 13	32,52
June 5	26,51	16	32,56
14	26,51	18	32,56
		20	33,46
Mean 4 1	26,19	Mean 4 1	32,90

Zenith dist. 4° 1′ 29″,55 + 3″,69 (refr. &c.) = 4°
Line of collimation 3,35.

52 *Herculis, S.*

May 14—4° 16′	53″,72	May 13—4° 17′	0″,15
June 11	53,23	16	0,34
14	52,63	June 8	0,60
17	54,90	13	0,63
20	54,02	16	0,60
		21	0,51
Mean 4 16	53,70	Mean 4 17	0,47

Zenith dist. 4° 16′ 57″,08 + 4″,20 (refr. &c.) = 4° 1
Line of collimation 3,76.

22 τ *Herculis.*

Face of limb, West.		Face of limb, East.	
May 11—3° 49′	30″,31	May 10—3° 49′	38″,10
14	29,26	13	37,23
16	30,63	June 8	35,04
June 5	29.92	13	35,88
11	29.43	18	35,86
14	30,09	21	36,83
17	29,86		
20	31,58		
Mean 3 49	30,16	Mean 3 49	36,49

Zenith dist. 3° 49′ 33″,32+3″,78 (refr. &c.)=3° 49′ 37″,10.
Line of collimation 3,16.

Capella, S.

May 12—4° 50′	55″,46	May 11—4° 50′	2,″79
15	54,02	13	1,47
June 8	54,87	June 11	2,0
15	55,87	16	2,26
21	56,91		
22	55,24		
Mean 4 50	55,49	Mean 4° 50	2,13

Zenith dist. 4° 59′ 58″,81+4″,07 (refr. &c.)=4° 50′ 2″,88.
Line of collimation 3,31.

Reduction of the Observations made at Clifton, (the northern Extremity of the meridional Arc,) and the Zenith Distances of the several Stars deduced therefrom.

β *Draconis, S.*

July 20—1° 0′	13″,82—	July 26—1° 0′	22″,41
22	13,15	29	20,26
28	12,38	Aug. 1	20,39
31	12,15	5	20,16
Aug. 3	13,29	8	20,15
7	12,87	12	21,25
3	13,42	17	20,11
18	13,80		
Mean 1 0	13,11	Mean 1 0	20,68

Zenith dist. 1° 0′ 16″,89+0″,95 (refr. &c.)=1° 0′ 17″,84.
Line of collimation 3,78.

γ *Draconis, S.*

July 20—1° 56′	21″,63	1° 56′ 28″,50
22	21,47	27,14
26	21,72	27,15
29	21,67	28,86
Aug. 1	22,90	28,54
11	20,45	28,28
13	21,55	28,66
18	21,03	
Mean 1 56	21,56	Mean 1 56 28,16

Zenith dist. 1° 56′ 24″,86+1″,78 (refr. &c.)=1° 56′ 26″,64.
Line of collimation 3,30.

45 *d Draconis, N.*

Face of limb, West.	Face of limb, East	
July 22—3° 26′ 23″,96	July 31—3° 26′ 16″,41	Zenith dist. 3° 26′ 19″,63 + 3″,29 (refr. &c.) = 3° 26
26 22,92	12 15,23	Line of collimation 3,72.
29 23,35	17 16,09	
Aug. 7 23,0		
13 23,7		
18 23,26		
Mean 3 26 23,36	Mean 3 26 15,91	

46 *c Draconis, N.*

July 20—1° 53′ 7″,60	July 28—1° 53′ 1″,11	Zenith dist. 1° 53′ 4″,44 + 1″,80 (refr. &c.) = 1° 53
22 8,01	31 52 59,97	Line of collimation 3,47.
Aug. 7 7,77	Aug. 3 53 1,99	
13 8,20	5 0,59	
18 8,04	12 1,34	
	17 0,84	
Mean 1 53 7,92	Mean 1 53 0,97	

51 *Draconis, S.*

Aug. 7—0° 21′ 33″,26	July 28—0° 21′ 41″,62	Zenith dist. 0° 21′ 37″,78 + 0″,34 (refr. &c.) = 0° 21
9 33,99	31 42,87	Line of collimation 4,15.
13 33,83	Aug. 5 42,16	
18 33,45	12 41,30	
	17 41,68	
Mean 0 21 33,63	Mean 0 21 41,93	

μ Draconis, N.

July 20—1° 16′ 39″,87	July 29—1° 16′ 34″,53	Zenith dist. 1° 16′ 36″,97 + 1″,23 (refr. &c.) = 1° 16
28 38,98	32,92	Line of collimation 3,25.
30 40,32		
Aug. 13 41,73		
Mean 1 16 40,22	Mean 1 16 33,72	

16 *Draconis, S.*

July 30—0° 7′ 47″,75	July 29—0° 7′ 54″,09	Zenith dist. 0° 7′ 51″,15 + 0″,10 (refr. &c.) = 0° 7
	Aug. 5 0 55,04	Line of collimation 3,40.
	Mean 0 7 54,56	

1 *κ Cygni, S.*

July 20—0° 26′ 55″,72	July 28—0° 27′ 3″,20	Zenith dist. 0° 26′ 59″,91 + 0″,41 (refr. &c.) = 0° 27
22 56,66	29 4,99	Line of collimation 3,68.
26 56,97	31 4,36	
29 56,35	Aug. 5 2,56	
30 55,28	12 4,29	
Aug. 7 56,45	17 2,20	
9 56,55		
13 56,36		
18 55,79		
Mean 0 26 56,23	Mean 0 27 3,60	

10 ι *Cygni, S.*

Face of limb, West.	Face of limb, East.	
July 20—2° 8′ 36″,86	July 28—2° 8′ 42″,47	Zenith dist. 2° 8′ 40″,23 + 1,″99 (refr. &c.) = 2° 8′ 42,″22.
29 35,01	31 44,05	Line of collimation 3,55.
30 36,42	Aug. 5 43,54	
Aug. 1 37,37	12 45,24	
7 37,62	17 43,76	
9 37,56		
18 35,96		
Mean 2 8 36,68	Mean 2 8 43,79	

γ *Ursæ, N.*

Aug. 17—1° 20′ 8,″84.

ζ *Ursæ, N.*

Aug. 5—2° 30′ 10″,72	July 29—2° 30′ 4,″59	Zenith dist. 2° 30′ 8″,18 + 2″,19 (refr. &c.) = 2° 30′ 10″,37.
9 12,38	Aug. 8 4,47	Line of collimation 3,37.
	17 5,39	
Mean 2 30 11,55	Mean 2 30 4,81	

η *Ursæ, S.*

July 23—3° 8′ 59,″78	Aug. 8—3° 9′ 8″,03	Zenith dist. 3° 9′ 4″,26 + 2″,72 (refr. &c.) = 3° 9′ 6″,98.
26 9 0,93	17 7,85	Line of collimation 3,67.
Aug. 4 9 1,07		
Mean 3 9 0,59	Mean 3 9 7,94	

85 ι *Herculis, S.*

July 20—7° 20′ 14″,13	July 23—7° 20′ 21″,69	Zenith dist. 7° 20′ 18″,08 + 6″,90 (refr. &c.) = 7° 20′ 24″,98.
28 13,19	5 22,57	Line of collimation 4,52.
31 12,93	17 23,59	
Aug. 1 12,86		
7 14,71		
Mean 7 20 13,56	Mean 7 20 22,61	

υ *Herculis, S.*

July 30—6° 51′ 46″,31	July 21—6° 51′ 52″,89	Zenith dist. 6° 51′ 50″,45 + 6″,35 (refr. &c.) = 6° 51′ 56″,80.
	29 56,32	Line of collimation 4,14.
	Mean 6 51 54,60	

52 *Herculis, S.*

July 28—7° 7′ 15″,02	July 29—7° 7′ 22″,76	Zenith dist. 7° 7′ 18″,69 + 6″,76 (refr. &c.) = 7° 7′ 25″,45.
30 14,21	Aug. 8 22,63	Line of collimation 4,04.
Mean 7 7 14,6	Mean 7 7 22,69	

22 τ *Herculis, S.*

July 30—6° 39′ 51″,84	July 29—6° 40′ 0″,32	Zenith dist. 6° 39′ 55″,11 + 6″,18 (refr. &c.) = 6° 40 1″,29.
Aug. 4 50,64	Aug. 13 39 58,02	Line of collimation 4,16.
7 51,80		
12 49,96		
Mean 6 39 51,06	Mean 6 39 59,17	

α *Persei, S.*

Face of limb, West.	Face of limb, East.	
Aug. 8—4° 18′ 29″,44	Aug. 13—4° 18′ 33″,15	Zenith dist. 4° 18′ 31″,65+4″,37 (refr. &c.)=4° 18″ 36′,02.
29,78	18 34,76	Line of collimation 2,28.
28,87		
Mean 4 18 29,36	Mean 4 18 33,95	

Capella, S.

Aug. 7—7° 40′ 15″,60	Aug. 8—7° 40′ 25″,30	Zenith dist. 7° 40′ 19″,06+6″,60 (refr. &c.)=7° 40′ 25″,66.
18 11,94	9 26,46	Line of collimation 5,30.
	19 21,32	
Mean 7 40 13,76	Mean 7 40 24,36	

Reduction of the Observations made at Arbury Hill, (the intermediate Point on the meridional Arc,) and the Zenith Distances of the several Stars deduced therefrom.

β *Draconis, N.*

Sept. 8—0° 13′ 47″,67	Sept. 18—0° 13′ 41″,91	Zenith dist. 0° 13′ 45″,61+0″,21 (refr. &c.)=0° 13′ 45″,82.
19 48,20	20 43,61	Line of collimation 2,71.
23 49,55	22 43,32	
25 48,76	24 43,90	
28 48,38	26 42,24	
30 49,10	29 43,54	
Oct. 3 46,63	Oct. 1 41,94	
Mean 0 13 48,33	Mean 0 13 42,92	

γ *Draconis, S.*

Sept. 10—0° 42′ 18″,72	Sept. 11—0° 42′ 23″,08	Zenith dist. 0° 42′ 22″,08+0″,65 (refr. &c.)=0° 42′ 22″,73.
19 20,01	18 25,43	Line of collimation 2,92.
23 18,03	20 25,49	
25 19,07	22 24,84	
26 20,07	24 24,67	
30 19,21	29 24,08	
Oct. 3 18,98	Oct. 1 26,95	
	2 25,56	
Mean 0 42 19,16	Mean 0 42 25,01	

45 *d Draconis, S.*

Sept. 8—4° 40′ 25″,36	Sept. 18—4° 40′ 19″,99	Zenith dist. 4° 40′ 22″,80+4″,41 (refr. &c.)=4° 40′ 27″,21.
15 29,16	20 19,65	Line of collimation 3,65.
19 28,37	24 19,22	
23 25,07	26 19,87	
25 25,57	28 18,86	
29 25,03	Oct. 1 16,57	
30 25,57	2 19,89	
Mean 4 40 26,45	Mean 4 40 19,15	

46 c *Draconis, N.*

Face of limb, West.		Face of limb, East.	
Sept. 15—3° 7′	9″,56	Sept. 7—3° 7′	2″,31
16	10,67	10	2,19
19	9,89	18	3,58
21	9,38	20	3,58
23	9,46	22	3,13
25	8,62	24	3,62
29	8,70	26	3,10
30	9,49	28	2,61
		Oct. 1	2,51
		2	3,79
Mean 3 7	9,47	Mean 3 7	3,04

Zenith dist. 3° 7′ 6″,25 + 3″,05 (refr. &c.) = 3° 7′ 9″,30.
Line of collimation 3,21.

51 *Draconis, N.*

Sept. 8—0° 52′	26″,01	Sept. 7—0° 52′	20″,13
16	27,89	10	23,30
19	27,60	18	21,23
23	25,70	20	20,26
25	25,98	22	20,06
29	24,59	26	20,05
30	27,43	28	19,87
		Oct. 1	21,01
		2	20,31
Mean 0 52	26,46	Mean 0 52	20,68

Zenith dist. 0° 52′ 23″,57 + 0″,85 (refr. &c.) = 0° 52′ 24″,42.
Line of collimation 2,89.

1 κ *Cygni, N.*

Sept. 8—0° 47′	4″,07	Sept. 7—0° 46′	57″,79
15	5,02	18	59,88
16	6,59	20	58,5
18	6,13	22 47	0,44
23	5,77	24 46	59,04
25	4,06	26	58,30
29	5,67	28	58,56
30	5,82	Oct. 1	59,13
		2	58,79
Mean 0 47	5,39	Mean 0 46	58,94

Zenith dist. 0° 47′ 2″,16 + 0″,76 (refr. &c.) = 0° 47′ 2″,92.
Line of collimation 3,22.

10 ι *Cygni.*

Sept. 19—0° 54′	35″,59	Sept. 18—0° 54′	40″,47
21	34,94	20	40,42
23	36,74	22	39,82
25	36,83	24	41,72
27	35,86	26	41,11
29	35,23	28	40,78
30	34,11	1	40,14
		2	40,24
Mean 0 54	35,62	Mean 0 54	40,59

Zenith dist. 0° 54′ 38″,21 + 0″,88 (refr. &c.) = 0° 54″ 39′,09.
Line of collimation 2,48.

γ *Ursæ, N.*

Face of limb, West.	Face of limb, East.	
Sept. 23—2° 34′ 12″,07	Sept. 18—2° 34′ 5″,73	Zenith dist. 2° 34′ 9″,59 + 2″,29 (refr. &c.) = 2° 34′ 11″,88.
26 15,28	5,29	Line of collimation 4,08.
Mean 2. 34 13,67	Mean 2 34 5,51	

η *Ursæ, S.*

Sept. 10—1° 55′ 1″,14	Sept. 20—1° 55′ 4″,41	Zenith dist. 1° 55′ 3″,03 + 1″,65 (refr. &c.) = 1° 55′ 4″,63.
23 54 59,80	24 4,84	Line of collimation 2,79.
25 55 2,57	26 7,75	
30 54 57,42	28 5,63	
	Oct. 3 6,41	
Mean 1 55 0,23	Mean 1 55 5,82	

ζ *Ursæ, N.*

Sept. 26—3° 44′ 11″,63	Sept. 24—3° 44′ 6″,99	Zenith dist. 3° 44′ 8″,63 + 3″,73 (refr. &c.) = 3° 44′ 12″,36.
	30 4,67	Line of collimation 3,0.
	Oct. 3 5,28	
	Mean 3 44 5,64	

22 τ *Herculis, S.*

Sept. 3—5° 25′ 50″,78	Sept. 18—5° 25′ 58″,80	Zenith dist. 5° 25′ 54″,79 + 5″,03 (refr. &c.) = 5° 25′ 59″,82.
		Line of collimation 4,01.

α *Persei, S.*

Sept. 16—3° 4′ 26″,57	Sept. 8—3° 4′ 30″,66	Zenith dist. 3° 4′ 29″,53 + 3″,07 (refr. &c.) = 3° 4′ 32″,60.
18 27,69	12 31,49	Line of collimation 2,63.
23 26,22	19 32,95	
26 27,10	22 32,91	
	25 32,91	
Mean 3 4 26,89	Mean 3 40 32,18	

Capella, S.

Sept. 14—6° 26′ 12″,39	Sept. 11—6° 26′ 19″,64	Zenith dist. 6° 26′ 16″,46 + 6″,44 (refr. &c.) = 6° 26′ 22″,90.
16 13,75	12 18,89	Line of collimation 2,89.
19 13,59	18 21,00	
21 14,68	20 19,10	
23 12,93	22 18,03	
26 14,48	25 19,64	
Mean 6 26 13,61	Mean 6 26 19,39	

Reduction of the Observations made at the Royal Observatory, and the Zenith Distances of the several Stars deduced therefrom.

β *Draconis, N.*

April 16—0° 58′ 37″,66	April 23—0° 58′ 28″,07	Zenith dist. 0° 58′ 32″,14 + 0″,99 (refr. &c.) = 0° 58′ 33″,13.
25 36,02		Line of collimation 4,07.
26 34,98		
Mean 0 58 36,22		

γ Draconis, N.

Face of limb, West.	Face of limb, East.	
April 16—0° 2′ 28″,37	April 22—0° 2′ 19″,05	Zenith dist. 0° 2′ 24″,36 + 0″,03 (refr. &c.) = 0° 2′ 24″,39.
19 29,92	23 20,54	Line of collimation 4,57.
25 28,55		
Mean 0 2 28,94	Mean 0 2 19,79	

45 d Draconis, N.

April 19—5° 25′ 14″,51	April 23—5° 25′ 6″,17	Zenith dist. 5° 25′ 10″,22 + 5″,59 (refr. &c.) = 5° 25′ 15″,81.
25 14,03		Line of collimation 4,05.
Mean 5 25 14,27		

46 c Draconis, N.

April 25—3° 51′ 57″,64.

51 Draconis, N.

April 19—1° 37′ 18″,23	April 23—1° 37′ 8″,79	Zenith dist. 1° 37′ 12″,61 + 1″,54 (refr. &c.) = 1° 37′ 14″,15.
25 14,62		Line of collimation 3,81.
Mean 1 37 16,42		

1 κ Cygni.

April 25—1° 31′ 54″,14	April 23—1° 31′ 46″,65	Zenith dist. 1° 31′ 50″,39 + 1″,48 (refr. &c.) = 1° 31′ 51″,87.
		Line of collimation 3,74.

10 ι Cygni.

April 19—0° 9′ 45″,02	April 23—0° 9′ 53″,90	Zenith dist. 0° 9′ 49″,41 + 0″,20 (refr. &c.) = 0° 9′ 49″,60.
		Line of collimation 4,44.

γ Ursæ.

April 24—3° 19′ 7″,08	April 21—3° 18′ 55″,69	Zenith dist. 3° 19′ 1″,43 + 3″,24 (refr. &c.) = 3° 19′ 4″,67.
	22 55,55	Line of collimation 5,65.
	23 56,12	
	Mean 3 18 55,78	

η Ursæ.

April 16—1° 10′ 10″,19	April 23—1° 10′ 17″,60	Zenith dist. 1° 10′ 13″,85 + 1″,22 (refr. &c.) = 1° 10′ 15″,07.
		Line of collimation 3,70.

85 ι Herculis.

April 16—5° 20′ 20″,47	April 23—5° 20′ 32″,04	Zenith dist. 5° 20′ 25″,10 + 5″,61 (refr. &c.) = 5° 20′ 30″,71.
19 15,87		Line of collimation 6,93.
Mean 5 20 18,17		

Capella.

April 13—5° 41′ 21″,09	April 24—5° 41′ 30″,91	Zenith dist. 5° 41′ 26″,42 + 5″,79 (refr. &c.) = 5° 41′ 32″,21.
21 22,74		Line of collimation 4,5.
Mean 5 41 21,91		

Previous to my entering on the following article, it ı not be improper to exhibit, under their proper points of v the several quantities derived from observation, expressiv the differences of the zenith distances, or the deviation of point of intersection of the meridional and horizontal wires f the true line of collimation.

At Dunnose.

	″
β Draconis	3,42
γ ———	3,64
45 *d* ———	4,46
46 *c* ———	3,41
51 ———	3,40
μ ———	3,68
16 ———	3,58
1 κ Cygni	3,80
10 ι ———	3,15
γ Ursæ	3,02
η ———	3,06
ζ ———	3,76
85 ι Herculis	3,46
υ ———	3,35
52 ———	3,76
22 τ ———	3,16
Capella	3,31

At Clifton.

β Draconis	3,78
γ ———	3,30
45 *d* ———	3,72
46 *c* ———	3,47
51 ———	4,15
μ ———	3,25
16 ———	3,40
1 κ Cygni	3,68

	″
10 ι Cygni	3·55
η Ursæ	3,67
ζ ——	3,37
85 ι Herculis	4,52
υ ——	4,14
52 ——	4,04
22 τ ——	4,16
α Persei	2,28
Capella	5,30

At Arbury Hill.

β Draconis	2,71
γ ——	2,92
45 d ——	3,65
46 c ——	3,21
51 ——	2,89
1 κ Cygni	3,22
10 ι ——	2,48
γ Ursæ	4,08
η ——	2,79
ζ ——	3,00
22 τ ——	4,01
α Persei	2,63
Capella	2,89

At Greenwich.

β Draconis	4,07
γ ——	4,57
45 d ——	4,05
51 ——	3,81
1 κ Cygni	3,74
10 ι ——	4,44
γ Ursæ	5,65
η ——	3,70
Capella	4,50

Amplitudes of the celestial Arc comprehended by the Stations Dunnose and Clifton.

	°	′	″
β Draconis.			
Zenith distance at Dunnose	1	50	5,24
Ditto - Clifton -	1	0	17,84
Amplitude of arc - -	2	50	23,08
γ Draconis.			
Zenith distance at Dunnose	0	53	56,63
Clifton -	1	56	26,64
Amplitude of arc -	2	50	23,27
45 *d Draconis.*			
Zenith distance at Dunnose	6	16	47,66
Clifton -	3	26	22,92
Amplitude of arc -	2	50	24,74
51 *Draconis.*			
Zenith distance at Dunnose	2	28	44,05
Clifton -	0	21	38,12
Amplitude of arc -	2	50	22,17
46 *c Draconis.*			
Zenith distance at Dunnose	4	43	28,93
Clifton -	1	53	6,24
Amplitude of arc -	2	50	22,69
16 *Draconis.*			
Zenith distance at Dunnose	2	42	33,26
Clifton -	0	7	51,25
Amplitude of arc -	2	50	24,51
μ Draconis.			
Zenith distance at Dunnose	4	6	59,30
Clifton -	1	16	38,20
Amplitude of arc -	2	50	21,10
10 *ι Cygni.*			
Zenith distance at Dunnose	0	41	40,68
Clifton -	2	8	42,22
Amplitude of arc -	2	50	22,90
1 *κ Cygni.*			
Zenith distance at Dunnose	2	23	22,86
Clifton -	0	27	0,32
Amplitude of arc -	2	50	23,18

	°	′	″
η Ursæ.			
Zenith distance at Dunnose	0	18	42,93
Clifton -	3	9	6,98
Amplitude of arc -	2	50	24,05
γ Ursæ.			
Zenith distance at Dunnose	4	10	36,23
Clifton -	1	20	13,53
Amplitude of arc -	2	50	22,70
ζ Ursæ.			
Zenith distance at Dunnose	5	20	35,66
Clifton -	2	30	10,37
Amplitude of arc -	2	50	25,29
52 *Herculis.*			
Zenith distance at Dunnose	4	17	1,28
Clifton -	7	7	25,45
Amplitude of arc -	2	50	24,17
85 *ι Herculis.*			
Zenith distance at Dunnose	4	30	1,95
Clifton -	7	20	24,98
Amplitude of arc -	2	50	23,03
υ Herculis.			
Zenith distance at Dunnose	4	1	33,24
Clifton -	6	51	56,80
Amplitude of arc -	2	50	23,56
22 *τ Herculis.*			
Zenith distance at Dunnose	3	49	37,10
Clifton -	6	40	1,29
Amplitude of arc -	2	50	24,19
Capella.			
Zenith distance at Dunnose	4	50	2,88
Clifton -	7	40	25,66
Amplitude of arc -	2	50	22,78

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Amplitudes of the celestial Arc comprehended by the Stations Dunnose and Arbury Hill.

β Draconis.

	°	′	″
Zenith distance at Dunnose	1	50	5,24
Arbury Hill	0	13	45,82
Amplitude of arc -	1	36	19,42

γ Draconis.

	°	′	″
Zenith distance at Dunnose	0	53	56,63
Arbury Hill	0	42	22,73
Amplitude of arc -	1	36	19,36

45 *d Draconis.*

	°	′	″
Zenith distance at Dunnose	6	16	47,66
Arbury Hill	4	40	27,21
Amplitude of arc -	1	36	20,45

51 *Draconis.*

	°	′	″
Zenith distance at Dunnose	2	28	44,01
Arbury Hill	0	52	24,42
Amplitude of arc -	1	36	19,59

46 *c Draconis.*

	°	′	″
Zenith distance at Dunnose	4	43	28,93
Arbury Hill	3	7	9,30
Amplitude of arc -	1	36	19,63

1 *κ Cygni.*

	°	′	″
Zenith distance at Dunnose	2	23	22,86
Arbury Hill	0	47	2,92
Amplitude of arc -	1	36	19,94

10 *ι Cygni.*

	°	′	″
Zenith distance at Dunnose	0	41	40,68
Arbury Hill	0	54	39,09
Amplitude of arc -	1	36	19,77

η Ursæ.

	°	′	″
Zenith distance at Dunnose	0	18	42,93
Arbury Hill	1	55	4,63
Amplitude of arc -	1	36	21,70

Capella.

	°	′	″
Zenith distance at Dunnose	4	50	2,88
Arbury Hill	6	26	22,90
Amplitude of arc -	1	36	20,02

Difference between the Parallels of Latitude of Dunnose and Greenwich.

β Draconis.

	°	′	″
Zenith distance at Dunnose	1	50	5,24
Greenwich	0	58	33,13
Difference of latitude	0	51	32,11

γ Draconis.

	°	′	″
Zenith distance at Dunnose	0	53	56,63
Greenwich	0	2	24,39
Difference of latitude	0	51	32,24

45 *d Draconis.*

	°	′	″
Zenith distance at Dunnose	6	16	47,66
Greenwich	5	25	15,81
Difference of latitude	0	51	31,85

51 *Draconis.*

	°	′	″
Zenith distance at Dunnose	2	28	44,05
Greenwich	1	37	14,25
Difference of latitude	0	51	29,90

1 *κ Cygni.*

	°	′	″
Zenith distance at Dunnose	2	23	22,86
Greenwich	1	31	51,87
Difference of latitude	0	51	30,99

10 *ι Cygni.*

	°	′	″
Zenith distance at Dunnose	0	41	40,68
Greenwich	0	9	49,60
Difference of latitude	0	51	30,28

γ Ursæ.

	°	′	″
Zenith distance at Dunnose	4	10	36,23
Greenwich	3	19	4,67
Difference of latitude	0	51	31,56

η Ursæ.

	°	′	″
Zenith distance at Dunnose	0	18	42,93
Greenwich	1	10	15,07
Difference of latitude	0	51	32,14

It will now be proper to exhibit the various results, as previously deduced; the amplitudes of the several arcs will then stand as follow.

Arc between Dunnose and Clifton.

	°	′	″	
β Draconis	2	50	23,08	
γ ———			23,27	
45 *d* ———			24,75	
46 *c* ———			22,69	
51 ———			22,17	
16 ———			24,51	
μ ———			21,10	Extreme results. Mean 23″,19, and might be rejected
ζ Ursæ			25,29	
γ ———			22,70	
η ———			24,05	
1 κ Cygni			23,18	
10 ι ———			22,90	
85 ι Herculis			23,03	
υ ———			23,56	
52 ———			24,17	
22 τ ———			24,19	
Capella			22,78	
Mean amplitude	2	50	23,38	

Between Dunnose and Arbury Hill.

β Draconis	1° 36′ 19″,42
γ ———	19,36
45 *d* ———	20,45
46 *c* ———	19,63
51 ———	19,59
1 κ Cygni	19,94
10 ι ———	19,77
η Ursæ	21,70
Mean amplitude	1 36 19,98

Between Dunnose and Greenwich.

β Draconis	0° 51′ 32″,11
γ ———	32,24
45 *d* ———	31,85
51 ———	29,90
1 κ Cygni	30,99
10 ι ———	30,28
γ Ursæ	31,56
η ———	32,14
Mean amplitude	0 51 31,39

It is very generally known that his Grace the Duke of MARLBOROUGH is possessed of an excellent quadrant, made by the late Mr. RAMSDEN, and that he has for some years been in the habit of using it at Blenheim. As my meridional line is not far eastward from his Grace's observatory, the zenith distance of any star or stars there determined, from a course of accurate observations, must afford me the means of ascertaining the lengths of the degrees on the meridian, at the middle points between Blenheim and the two extremities of my arc. I therefore applied to his Grace, requesting him to favour me with any observations he might have made, and with permission to publish them, if I thought proper. His Grace was pleased to comply with my request; and I now avail myself of the advantage procured by that condescension.

Blenheim Observatory.

Zenith Distances of γ Draconis, reduced to the Beginning of the Year 1794, *from Observations made in five successive Years, by his Grace the Duke of* MARLBOROUGH.

From the observations of	1794,	0° 19′ 17″,32	γ Draconis south of the zenith.
	1795	17,70	
	1796	17,51	
	1797	17,48	
	1798	17,32	
	Mean	0 19 17,46.	

Therefore, the mean zenith distance of γ Draconis, at Blenheim, on the 1st of January, 1802, may be taken at 0° 19′ 23″,06 south. The zenith distance of this star, at the same period, at the station Dunnose, as derived from the late operation, is 0° 53′ 56″,63 north; therefore, 0° 53′ 56″,63 + 0° 19′ 23″,06 = 1° 13′ 19″,69, is the difference of latitude between Dunnose and Blenheim observatory; and here, perhaps, it may not be improper to advert to page 675 of the Phil. Trans. for 1800, where the observed and computed latitudes are given, the former being 51° 50′ 24″.9, and the latter 51° 50′ 28″,1. The latitude of Dunnose is 50° 37′ 8″,21, that of Greenwich being taken at 51° 28′ 40″; and their difference 0° 51′ 31″,39, as derived from the observations made with the new sector. Hence, 50° 37′ 8″.21 + 1° 13′ 19″,69 = 51° 50′ 27″,9, must be the latitude of Blenheim, within a small part of a second of the truth. But it will be improper to dwell on this matter at present; and, therefore, I shall conclude this article with giving, in order, the subtenses in the heavens, of the different parts of my terrestrial arc.

1. Dunnose and Clifton	2°	50′	23″,38
2. Dunnose and Arbury Hill	1	36	19,98
3. Arbury Hill and Clifton	1	14	3,40
4. Dunnose and Greenwich	0	51	31,39
5. Greenwich and Clifton	1	58	51,59
6. Arbury Hill and Greenwich	0	44	48,19
7. Dunnose and Blenheim	1	13	19,69
8. Blenheim and Clifton	1	37	3,69

Determination of the Lengths of the Degrees on the Meridian, in the middle Points of the several Arcs given in the last Article.

On a reference to the Phil. Trans. for 1800, it will be found, that Blenheim Observatory is 446458 feet from the perpendicular to the meridian of Dunnose. But the parallel to the perpendicular at Dunnose, from that observatory, where it cuts the meridian of the former, is about $\frac{4}{10}$ of a second in latitude north of the latter; therefore, 446498 feet may be taken for the distance of Blenheim north of Dunnose. This premised, we have the following terrestrial arcs, in conjunction with the preceding celestial ones, for computing the lengths of the several degrees.

Arcs.	Feet.
1. Dunnose and Clifton	1036337
2. Dunnose and Arbury Hill	586320
3. Arbury Hill and Clifton	450017
4. Dunnose and Greenwich	313696
5. Greenwich and Clifton	722641
6. Arbury Hill and Greenwich	272624
7. Dunnose and Blenheim	446498
8. Blenheim and Clifton	589839

And, by simply dividing the terrestrial arcs by their corresponding celestial ones, and afterwards multiplying the several quotients by 3600″, we shall get the lengths of the degrees as follows.

		Fathoms.
Middle point between	Dunnose and Clifton	60820
	Dunnose and Arbury Hill	60864
	Arbury Hill and Clifton	60766
	Dunnose and Greenwich	60884
	Greenwich and Clifton	60794
	Arbury Hill and Greenwich	60849
	Blenheim and Clifton	60769
	Blenheim and Dunnose	60890

Taking the latitude of Greenwich at 51° 28′ 40″, from the several arcs now given, the latitudes of their middle points are easily found; and, with the lengths of the degrees, when properly arranged, will stand as follows.

	Latitude of middle point.	Fathoms.
Arbury Hill and Clifton	52° 50′ 29″,8	60766
Blenheim and Clifton	52 38 56,1	60769
Greenwich and Clifton	52 28 5,7	60794
Dunnose and Clifton	52 2 19,8	60820
Arbury Hill and Greenwich	51 51 4,1	60849
Dunnose and Arbury Hill	51 35 18,2	60864
Blenheim and Dunnose	51 13 18,2	60890
Dunnose and Greenwich	51 2 54,2	60884

Note. The altitude of Arbury Hill, above the level of the sea, is 804 feet. The altitudes of the stations southward of Arbury Hill, are given in the former accounts of the trigonometrical operations: those to the northward of Arbury Hill may be found from the following *data*.

At Sutton, Heathersedge, elev. 15′ 25″; Gringley, dep. 18′ 47″.—*At Castle Ring*, Orpit Heights, dep. 5′ 26″; Bardon Hill, dep. 6′ 48″; Corley, dep. 14′ 26″.—*At Heathersedge*, Orpit Heights, dep. 20′ 27″.—*At Clifton*, Heathersedge, elev. 29′ 12′; Gringley, dep. 13′ 40″.—*At Hollan Hill*, Bardon Hill, elev. 2′ 35″; Orpit Heights, elev. 12′ 0″; Sutton, elev. 7′ 12″.—*At Bardon Hill*, Corley, dep. 16′ 3″; Arbury Hill dep. 16′ 0″; Castle Ring, dep. 12′ 30″; Sutton, dep. 19′ 48″; Orpit Heights, dep. 6′ 35″

CONCLUSION.

From this measurement it appears, that the length of a degree on the meridian, in latitude 52° 2′ 20″, is 60820 fathoms. This conclusion is deduced from the supposition of the whole arc subtending an angle of 2° 50′ 23″,38 in the heavens, and a distance of 1036337 feet on the surface of the earth.

The length of the degree at the middle point (51° 35′ 18″) between the southern extremity of the arc and Arbury Hill, is 60864 fathoms; which is greater than the above, and exceeds it by 44 fathoms. But this degree, admitting the earth to be an ellipsoid, with the ratio of its axes as 229 to 230, should be about 10 fathoms less. If the measurement of the terrestrial arc be sufficiently correct, and the earth of an elliptical form in these latitudes, either the arcs affording the deductions are incorrect, or some material deflection of the plumb-line has taken place, at one or two stations, from the effect of attraction.

Without arrogating to myself any merit from the pains taken in the performance of this undertaking, I may say, I am so perfectly convinced of the general accuracy of the whole, that I cannot for a moment doubt the collective evidence of its sufficiency. From an examination of my field books, and from the remeasurement of the chains used in our base-line on Misterton Carr, I think it is probable that an error in the whole distance, of 197 miles nearly, does not subsist to an amount of more than 100 feet, corresponding to 1″ in the amplitude of the whole arc; and I also think it probable it cannot amount to half that quantity. The supposition of the zenith distances of the stars being generally erroneous, at any one station, cannot be admitted, unless it should be imagined, that the plane of the sector's limb was not got into that of the meridian. Such an idea, however, can scarcely be entertained, after a careful examination of the several observations, and a due attention to the means by which the instrument was made to assume its right position. Perhaps, also, I should not fail to observe, in this place, that although the instrument was always brought into the plane of each meridian by means of the telescope attached to the side of the great tube, and the azimuth circle, yet, having two good chronometers in my possession, I repeatedly verified the truth of the sector's position, by observing the transits of two stars, north and south of the zenith, at the greatest distances my arc would admit of. But, to return, if there be an error in the amplitude of the total arc, from a deflection of the plumb-line at either of the stations, it is not probable that any such deflection existed at Dunnose; as the deviation of it towards the north, from a deficiency of matter towards the channel, would tend to diminish the inequality between the lengths of the two degrees. This will be evident, on consideration. I am therefore disposed to believe that the plumb-line was drawn towards the south, from the action of matter, both at the northern extremity of the arc and at Arbury Hill, but more particularly at the first-mentioned station. If this were partly the case, and both Dunnose and Arbury Hill were free from any such prevailing cause, the total arc must be too great, if taken at 2° 50′ 23″,38, by about 8″, nearly answering to 2″ on each degree. A deviation of 8″ from the true vertical, is a large quantity; nor can the cause of it be assigned, unless it be also supposed, that the matter producing that deflection extends in a southern direction *beyond* Arbury Hill. If the error, though not probable, as above observed, be supposed to exist at Dunnose, it must amount to more than 10″; and that too from the effects of attraction in a southern direction, where the deficiency of matter would lead us to believe the reverse would happen.

I am perfectly aware that it is possible to state a case, in which the plumb-line of a sector would deviate from the true vertical by such a quantity. Thus, for instance, in a chalky county, like the southern part of the kingdom, if the instrument were set up adjoining the terminations of two strata running east and west, one of chalk and the other of much denser materials, the effect would be as we have found it. But, at Dunnose, this argument does not apply; nor is there reason to believe, from external appearances, that it will do so, with regard either to Arbury Hill or the northern extremity of the meridional line.

It was the discovery of the disagreement between the subtense in the heavens, of the whole arc, and its corresponding terrestrial one, with those of its parts, which led me to apply to his Grace the Duke of MARLBOROUGH, for the observations made at Blenheim on γ Draconis, or some other star. His Lordship's compliance with my request, is shown, from the Table of results, to be serviceable; as the arc contained between the observatory at Blenheim and Dunnose, deduced from his Grace's observations, and those made at the latter place, with the meridional distance 446498 feet, give 60890 fathoms, for the length of the degree on the meridian in latitude 51° 13′; which agrees nearly with the length of the degree at the middle point between Greenwich and Dunnose. However, under all considerations of the means by which the degree in 51° 13′ has been obtained, I am inclined to believe there is an uncertainty in it, of 6 or 7 fathoms, answering to about $\frac{1}{2}''$ in latitude.

But, if the measured space between his Grace's observatory and

Dunnose, with its amplitude, (1° 13′ 19″,69) be used in finding the meridional distance of the whole arc, (its corresponding amplitude,) we shall get 2° 50′ 11″,80 for its subtense; which argues a deflection from the vertical at Clifton = 11″,79. If the meridional distance between Dunnose and Greenwich be used, we shall, from the same mode of proceeding, make it = 10″,3. In short, the general tenor of the observations seems to prove, that the plumb-line of the sector has been drawn towards the south at all the stations; and that by attractive forces, which increase as we proceed northward. On a further prosecution of this Survey, the zenith sector will be taken forward in that direction, which will afford an opportunity of throwing further light on this interesting subject. But meridional operations carried on in insular countries, are not so likely to afford just conclusions with regard to the different lengths of the degrees, as the same operations conducted in places very remote from deep seas.

From the late operations of the French Academicians it appears, that the meridional distance between Dunkirk and Barcelona is 275792,36 modules, the metre being 443,296 lines of the Peru toise = 0,256537th part of the module, at the temperature of melting ice. This meridional distance, therefore, converted into English feet, is 3527921. The distance between Dunkirk and Paris is 133758 feet, and the distance between Paris and Greenwich = 963954 feet; therefore, 830196 feet is the distance between Greenwich and Dunkirk. The distance between Greenwich and Clifton is 722641 feet; hence, 4411968 feet is the meridional distance between Clifton and Barcelona. The latitude of Barcelona is 41° 21′ 48″,8; the latitude of Greenwich is 51° 28′ 40″; and if to this latitude we add 1° 58′ 51″,59, the arc between Clifton and Greenwich, we shall get

53° 27′ 31″,59 for the latitude of Clifton; and shall then have the difference of latitude between Barcelona and Clifton = 12° 5′ 42″,79, something more than the 30th part of the whole circumference of the earth. With this difference of latitude, and the abovementioned distance, we shall get 60795 fathoms, for the mean length of a degree on the earth's surface, in latitude 47° 24′. The latitude of Paris is 48° 50′ 15″; this, with that of Clifton, gives 4° 37′ 16″,59 for the difference between their parallels. The meridional distance is 1686595 feet; hence, 60825 fathoms, is the length of the degree in latitude 51° 9′.

With regard to the latitudes of places published in our former papers, those referred to the meridian of Greenwich are to remain uncorrected, since the computations were made with nearly the same length of a degree on the meridian, as that at the middle point, now deduced, between Dunnose and Greenwich, *viz.* 60884 fathoms. As to those places referred to the new meridian, *viz.* Dunnose, Butterton, and St. Agnes Beacon, 1″ is to be added to the latitudes of them all; because the latitude of Dunnose became the standard, which was then computed to be 50° 37′ 7″,3, but is now found, from the zenith distances of the stars observed there and at Greenwich, to be 50° 37′ 8″,2.

By way of Appendix to this Paper, I shall subjoin the latitudes and longitudes of those places intersected in the survey of Essex, Suffolk, &c. whose distances from their respective places of observation are given in the Phil. Trans. for 1800; this cannot but be highly useful, as they may be depended on, the interior survey of those parts having since proved that no erroneous intersections were made.

APPENDIX.

Bearings of the principal Stations in the Counties of Essex, &c. from the Parallels to the Meridian of Greenwich; and likewise their Distances from that Meridian.

Names of stations.		Bearings.	Distance from meridian.	Mean.	Distance from perpendicular.	Mean.
		° ′ ″	Feet.	Feet.	Feet.	Feet.
Severndroog	New Station, Wrotham	46 27 19 SE	71978	71977 E	59145	59144½ S
Old Station, Wrotham		38 43 11 NE	71976		59144	
Severndroog	Gravesend	80 53 20 SE	84888	8488½ E	15434	15433½ S
New Station, Wrotham		16 27 19 NE	84889		15433	
Severndroog	Langdon Hill	68 48 4 NE	96515	96515 E	27920	27920½ N
Gravesend		15 0 39 NE	96515		27921	
Gravesend	Hadleigh	49 32 32 NE	133643	133643½ E	26145	26145 N
Langdon Hill		87 15 37 SE	133644		26145	
Hadleigh	Halstow	7 45 59 SW	129041	129040 E	7607	7607 S
Gravesend		79 56 53 NE	129039		7607	
Gravesend	Gads Hill	68 24 46 SE	105603	105603 E	23629	23629 S
Halstow		55 38 32 SW	105603		23629	
Gad's Hill	Sheppey	88 46 1 NE	176273	176273 E	22108	22108½ S
Halstow		72 55 56 SE	176273		22109	
Hadleigh	South End	80 11 2 SE	160836	160836 E	21441	21441 N
Sheppey		19 31 7 NW	160836		21441	
Halstow	Rayleigh	11 17 7 NE	138709	138709½ E	40851	40850½ N
Sheppey		30 49 17 NW	138710		40850	
Halstow	Prittlewell	42 47 6 NE	160844	160844 E	26757	26756½ N
Sheppey		17 31 22 NW	160844		26756	
Halstow	Canewdon	33 18 22 SE	168413	168413 E	51908	51907½ N
Sheppey		6 16 7 NW	168413		51907	
Halstow	Flagstaff, Sheerness	86 3 48 SE	170376	170374½ E	10451	10449 S
Hadleigh		45 6 25 SE	170373		10447	
Rayleigh	Danbury	9 55 10 NW	130525	130528½ E	87654	87664 N
Frierning		71 57 58 NE	130531		87664	
Langdon Hill		29 39 21 NE	130530		87662	
Severndroog	Frierning	42 23 31 NE	83919	83919 E	72488	72487½ N
Langdon Hill		15 46 56 NE	83919		72487	
Rayleigh	Signal Staff, Shoeburyness	59 55 0 SE	179732	179734 E	17086	17089 N
Langdon Hill		82 35 14 SE	179736		17093	
Rayleigh	Old Station, Tiptree	13 45 9 NE	156314	156314 E	112779	112785 N
Danbury		45 44 2 NE	156310		112790	
Frierning		60 53 59 NE	156320		112786	
Tiptree*	Tillingham Steeple	54 44 17 SE	200547	200544½ E	81511	81514 N
Danbury		84 58 57 SE	200542		81518	

* Triptree, by mistake, in the former part of this Survey.

Names of stations.		Bearings.				Distance from meridian.	Mean.	Distance from perpendicular.	Mean.
		°	′	″		Feet.	Feet.	Feet.	Feet.
Danbury -	Peldon	62	33	13	NE	200463	200464 E	123986	123984 N
Tillingham -		0	6	23	NW	200465		123983	
Peldon -	Flagstaff, St. Osyth Priory	83	48	39	SE	243805	243808 E	119284	119283 N
Tillingham -		48	52	57	NE	243812		119282	
Danbury -	Great Tey Steeple	30	12	45	NE	169380	169381 E	154381	154381 N
Peldon - -		45	38	20	NW	169382		154381	
Peldon -	Stoke Steeple	0	35	41	NE	201127	201127 E	187921	187921 N
Great Tey -		43	25	34	NE	201127		187921	
Peldon -	Thorp Steeple	75	21	46	NE	263163	263163 E	140362	140359 N
Stoke - -		52	30	43	SE	263164		140358	
Peldon -	Little Bentley	60	4	57	NE	244846	244846 E	149523	149523 N
Thorp - -		63	25	21	NW	244846		149523	
Little Bentley	Dover Court	63	32	9	NE	283323	283322 E	168677	168676 N
Thorp -		35	26	59	NE	283321		168675	
Tillingham -	West Mersea	11	58	27	NE	206545	206544 E	109809	109810 N
Danbury -		73	45	20	NE	206543		109811	
Great Tey	St. Mary's, Colchester	84	22	42	SE	202276	202276 E	151143	151143 N
Stoke - -		1	47	26	SE	202276		151143	
St. Mary's Colchester -	Little Bromley	76	2	46	NE	234987	234987 E	159270	159270 N
Stoke -		49	45	52	SE	234988		159270	
Thorp - -	Tattingstone	14	37	54	NW	250358	250353 E	189406	189402 N
Dover Court		57	50	38	NW	250351		189405	
Stoke -		88	17	13	NE	250350		189393	
Tattingstone	Rushmere	35	36	22	NE	270865	270864 E	218047	218048 N
Dover Court		14	9	47	NW	270864		218050	
Rushmere -	Falkenham	52	35	7	SE	302055	302054 E	194188	194189 N
Dover Court		36	17	7	NE	302054		194190	
Rushmere -	Woodbridge	69	24	43	NE	295524	295524 E	227311	227311 N
Falkenham		11	9	17	NW	295524		227312	
Woodbridge	Butley Steeple	85	40	43	NE	329485	329485 E	229878	229878 N
Falkenham -		37	32	43	NE	329485		229879	
Falkenham	Light House, Orford	59	30	44	NE	354267	354266 E	224929	224929 N
Butley -		78	42	16	SE	354266		224931	
Rushmere -	Otley Steeple	6	39	43	NE	274256	274254 E	247089	247088 N
Woodbridge		47	5	17	NW	274252		247087	
Otley - -	Henley Steeple	53	4	43	SW	259074	259075 E	235681	235681 N
Rushmere -		33	45	47	NW	259076		235681	
Henley -	Copdock Steeple	23	3	13	SW	245556	245557 E	203918	203917 N
Rushmere -		60	49	13	SW	245559		203917	
Copdock -	Naughton Steeple	51	26	57	NW	214045	214045 E	229030	229030 N
Henley - -		81	35	53	SW	214046		229030	
Great Tey -	Twinstead Steeple	12	47	14	NW	161215	161206 E	161198	161198 N
Stoke - -		86	26	30	NW	161198		161198	
Stoke -	Lavenham	28	18	20	NW	178348	178348 E	230216	230216 N
Glemsford -		87	4	35	NE	178348		230216	
Stoke -	Bulmer	73	17	13	NW	154916	154915 E	201792	201792 N
Lavenham -		39	30	10	SW	154915		201793	

Names of stations.		Bearings.	Distance from meridian.	Mean.	Distance from perpendicular.	Mean.
		° ′ ″	Feet.	Feet.	Feet.	Feet.
Lavenham -	Glemsford	87 4 35 SW	152635	152636 E	228903	228903 N
Bulmer - -		4 48 30 NW	152636		228903	
Bulmer -	Toppesfield •	77 14 50 SW	120796	120796 E	194070	19 069 N
Lavenham -		57 52 10 SW	120796		194069	
Severndroog	Southweald	39 49 54 NE	61300	61298 E	52599	52596 N
Langdon Hill		54 59 11 NW	61296		52593	
Tiptree -	Gallywood Common	57 45 6 SW	120796	120796 E	80657	80658 N
Danbury -		74 25 56 SW	120796		80659	
Gallywood Common - -	Pleshey •	17 28 50 NW	93384	93385 E	118789	118787 N
Tiptree -		84 33 10 NW	93386		118786	
Gallywood Common - -	High Easter	33 14 20 NW	79208	79208 E	120610	120611 N
Pleshey -		82 39 50 NW	79209		120612	
Danbury -	Hatfield Oak	62 7 31 NW	55309	55306 E	127468	127466 N
Pleshey -		77 9 51 NW	55303		127464	
Pleshey - -	Beauchamp Roding	63 25 9 SW	64941	64940 E	104555	104555 N
Hatfield Oak		22 49 0 SE	64940		104556	
Danbury -	Thaxted	31 33 51 NW	77490	77481 E	174002	173995 N
Lavenham -		60 52 10 SW	77475		174000	
Stoke - -		83 34 10 SW	77480		173985	
Severndroog	Brentwood Spire	44 23 29 NE	68984	68984 E	52063	52061 N
Langdon Hill		48 45 17 NW	68984		52060	
St. Paul's -	Old Station, High Beech	29 8 28 NE	8117	8117 E	67219	67219 N
Severndroog		4 44 36 NW	8117		67219	
St. Paul's -	Station, Hampstead	43 14 15 NW	39822	39824 W	32055	32055 N
High Beech -		53 44 33 SW	39826		32056	
St. Paul's -	New Station, High Beech	28 45 2 NE	7661	7661 E	67265	67264 N
Old Station, High Beech -		84 18 44 NW	7661		67264	
High Beech -	Epping Mill	53 4 40 NE	21742	21742 E	77457	77457 N
Severndroog		5 24 9 NE	21742		77457	
High Beech -	Berkhampstead Gazebo	46 15 36 NW	27987	27990 W	101790	101788 N
Epping Mill		63 56 1 NW	27993		101786	
Hatfield Oak -	Nasing Steeple	55 36 7 SW	10875	10875 E	97046	97046 N
Hatfield Oak	Henham on the Mount	0 35 42 NE	55710	55701 E	166727	166701 N
Thaxted -		71 24 58 SW	55692		166674	
Henham -	Thorley Steeple	36 40 8 SW	32376	32366 E	135373	135377 N
Hatfield -		70 57 48 NW	32356		135381	
Henham - -	Elmdon	35 5 52 NW	29669	29664 E	203744	203730 N
Thaxted -		58 8 32 NW	29660		203717	
Elmdon -	Rickling	22 34 52 SE	40925	40928 E	176651	176657 N
Henham -		55 59 52 NW	40931		176664	
Elmdon - -	Albury	11 37 43 SW	19669	19660 E	155071	155072 N
Henham -		72 6 30 SW	19651		155073	
Elmdon -	Balsham	49 57 18 NE	71969	71969 E	239285	239278 N
Thaxted -		4 49 38 NW	71970		239272	

• Topplesfield, } by mistake, in the former part of this Survey.
• Pleshley, }

Names of stations.		Bearings.				Distance from meridian.	Mean.		Distance from perpendicular.	Mean.	
		°	′	″		Feet.	Feet.		Feet.	Feet.	
Elmdon -	Babraham Mount	26	18	32	NE	48970	48976	E	242777	242770	N
Balsham -		81	22	4	NW	48982			242762		
Elmdon -	Triplow	13	27	58	NW	23888	23891	E	227854	227850	N
Babraham Mount		59	15	2	SW	23894			227846		
Langdon Hill	Hornchurch	87	1	36	NW	51738	51747	E	30245	30246	N
Severndroog		47	41	55	NE	51744			30248		
Gravesend -	Purfleet Cliff	60	30	51	NW	53972	53974	E	2048	2050	N
Hornchurch -		4	31	59	SE	53976			2050		
Severndroog	Barking	7	57	53	NE	17541	17544	E	20068	21069	N
Hornchurch -		74	58	39	SW	17547			21070		
St. Paul's -	Westham	71	14	54	NE	2265	2264	E	21387	21387	N
Severndroog		24	48	33	NW	2264			21388		

Bearings of secondary Objects, &c.

Severndroog	Chigwell	4	30	54	NE	18578	18581	E	53508	53510	N
Highbeech -		37	21	14	SE	18585			53513		
Severndroog	Billericay Chapel	54	20	37	NE	95374	95373	E	54286	54286	N
Friерning -		32	10	59	SE	95373			54286		
Hornchurch	Chimney of Public House	60	27	19	SW	22826	22821	E	13857	13855	N
Barking -		36	9	21	SE	22817			13853		
Purfleet Cliff	Rainham Steeple	38	43	29	NW	43722	43723	E	14835	14835	N
Hornchurch -		27	29	1	SW	43725			14836		
Hornchurch	Belvidere	27	18	51	SW	37806	37807	E	3263	3266	N
Purfleet -		85	40	59	NW	37808			3270		
Hornchurch -	Valence Tree	89	28	19	NW	31338	31335	E	30434	30432	N
Purfleet -		38	34	59	NW	31332			30430		
Rainham -	Cold Harbour	3	1	31	SW	43138	43137	E	3762	3761	N
Purfleet -		81	1	59	NW	43137			3760		
Gravesend -	Chadwell Steeple	1	13	50	NW	84524	84524	E	1570	1570	N
Severndroog		85	25	30	NE	84524			1571		
Gravesend -	Greys Steeple	36	52	50	NW	73799	73799	E	653	653	S
Chadwell -		78	17	30	SW	73799			653		
Gravesend -	Flagstaff, Mr. Button's	38	59	50	NW	70491	70491	E	2348	2347	N
Chadwell -		86	49	50	NW	70491			2347		
Gravesend -	West Thurrock Steeple	52	56	50	NW	66967	66967	E	1902	1902	S
Chadwell -		78	48	40	SW	66967			1903		
Gravesend -	West Tilbury Steeple	17	38	10	NE	89420	89420	E	1181	1181	S
Chadwell -		60	40	20	SE	89421			1181		
Gravesend -	Northfleet Steeple	70	45	17	NW	76623	76623	E	12548	12548	S
Chadwell -		29	13	52	SW	76623			12549		
Gravesend -	Horndon Spire	13	10	9	NE	92494	92496	E	17070	17072	N
Hornchurch -		72	5	26	SE	92498			17074		
Gravesend -	Flagstaff, East Tilbury	56	2	10	NE	98431	98431	E	6312	6312	S
Chadwell -		60	27	20	SE	98432			6313		
Gravesend -	Fobbing Steeple	34	47	40	NE	108532	108534	E	18591	18591	N
Halstow -		38	2	57	NW	108535			18592		

Names of stations.		Bearings.				Distance from meridian.	Mean.	Distance from perpendicular.	Mean.
		°	′	″		Feet.	Feet.	Feet.	Feet.
Halstow - -	Thundersley Steeple	1	36	20	NE	—	130198 E	—	33719 N
Sheppey -	Leigh Steeple	30	29	48	NW	149211	149211 E	23840	23839 N
Halstow -		32	40	43	NE	149211		23838	
Prittlewell -	Little Wakering Steeple	76	58	11	NE	179943	179940 E	31175	31176 N
Canewdon -		29	38	19	SE	179937		31178	
Prittlewell -	Bank Flagstaff	83	58	11	NE	192575	192572 E	30108	30109 N
Canewdon -		48	15	19	SE	192570		30110	
Bank Flagstaff	Foulness Chapel	33	4	41	NE	203200	203199 E	46426	46426 N
Canewdon -		81	6	49	SE	203198		46427	
Tillingham -	Tillingham Grange Signal Staff	40	45	13	SE	209676	209676 E	70916	70917 N
Peldon - -		9	50	52	SE	209676		70918	
Tillingham -	Bradwell Point Signal Staff	43	21	35	NE	213453	213453 E	95184	95185 N
Peldon -		24	16	41	SE	213453		95187	
Tillingham -	Brightlingsea Steeple	30	56	17	NE	229383	229382 E	129627	129627 N
Peldon -		78	57	17	NE	229381		129628	
Tillingham -	Toleshunt Major	47	39	58	NW	173531	173531 E	106122	106123 N
Peldon -		56	27	2	SW	173531.		106124	
Tillingham -	Tolesbury Steeple	27	50	13	NW	189052	189051 E	103277	103278 N
West Mersea		69	31	40	SW	189050		103279	
Tillingham -	Althorn Steeple	61	20	37	SW	172511	172512 E	66194	66192 N
Tiptree -		19	10	14	SE	172513		66191	
Althorn -	Burnham Steeple	62	50	23	SE	185324	185324 E	59619	59620 N
Tillingham -		34	48	27	SW	185324		59621	
Langdon Hill	Rettenden Steeple	45	18	38	NE	126748	126747 E	57827	57822 N
Rayleigh -		35	11	19	NW	126747		57817	
Langdon Hill	Runwell Steeple	44	47	13	NE	121154	121151 E	52743	52740 N
Rayleigh -		55	54	27	NW	121148		52737	
Rayleigh -	GreatBurstead Steeple *	82	34	27	NW	96984	96987 E	46288	46293 N
Danbury -		39	2	12	SW	96990		46299	
Gallywood Common -	East Hanningfield Steeple	63	53	54	SE	125885	125884 E	70617	70618 N
Danbury -		15	14	49	SW	125884		70619	
Canewdon -	Hockley Steeple	82	24	42	SW	144794	144796 E	48798	48798 N
Danbury -		20	9	38	SE	144799		48798	
Rettenden -	Stow, St. Mary's	63	26	42	NE	147833	147836 E	68360	63358 N
Canewdon -		50	59	18	NW	147839		68357	
Frierning -	Stock Steeple	71	54	14	SE	99912	99912 E	67262	67261 N
Danbury -		56	19	22	SW	99912		67261	
Tiptree -	Southminster Steeple	36	6	6	SE	188765	188762 E	68286	68289 N
Tillingham -		41	42	29	SW	188760		68292	
Peldon - -	Layer Marney Steeple	82	30	52	NW	180456	180457 E	126613	126612 N
Tillingham -		24	0	27	NW	180458		126612	
Peldon -	St. Osyth Point Signal Staff	80	26	29	SE	260322	260323 E	113906	113905 N
Tillingham		61	33	1	NE	260324		113904	
Thorp Steeple	Great Clackton Sig. Staff	26	32	57	SE	272780	272780 E	121112	121111 N
Little Bentley		44	30	52	SE	272780		121111	

* Great Burghstead, by mistake, in the former part of this Survey.

Names of stations.		Bearings.				Distance from meridian.	Mean.		Distance from perpendicular.	Mean.	
		°	'	"		Feet.	Feet.		Feet.	Feet.	
Dover Court	Frinton *	10	50	11	SW	275991	275991	E	130375	130375	N
Thorp Steeple	Steeple	52	6	20	SE	275992			130375		
Thorp	Great Clack-	3	45	53	SW	261921	261921	E	121481	121481	N
Peldon	ton Steeple	87	40	1	SE	261921			121481		
Dover Court	Frinton Signal	3	49	35	SE	285637	285638	E	134068	134068	N
Thorp	Staff	74	21	45	SE	285639			134068		
Dover Court	Walton Tower	17	48	27	SE	291358	291358	E	143661	143661	N
Thorp		83	19	21	NE	291359			143661		
Dover Court	Cupola, Lan-	81	29	29	NE	298242	298242	E	170909	170909	N
Thorp	guard Fort	48	56	56	NE	298243			170909		
Thorp	Ardleigh	58	21	57	NW	222726	222726	E	165270	165267	N
Peldon	Steeple	28	20	12	NE	222726			165265		
Great Tey	Frating	78	10	31	SE	231313	231313	E	141415	141414	N
Peldon	Steeple	60	31	56	NE	231313			141414		
Thorp	Thorrington	86	16	44	SW	239323	239323	E	138810	138809	N
Little Bentley	Steeple	27	16	2	SW	239324			138809		
Thorp	Kirby Steeple	84	44	24	SE	276355	276354	E	139146	139146	N
Dover Court		13	16	47	SW	276353			139146		
Dover Court	Brantham	74	38	51	NW	242253	242254	E	179953	179951	N
Tattingstone	Steeple	40	35	22	SW	242255			179950		
Dover Court	Harwich	58	39	3	NE	290907	290909	E	173297	173297	N
Rushmere	Steeple	24	7	47	SE	290911			173297		
Kirby Steeple	Little Oakley	5	5	13	NW	274475	274474	E	160255	160255	N
Dover Court		46	24	59	SW	274474			160255		
Dover Court	Bawdsey	51	49	28	NE	319624	319624	E	197218	197217	N
Rushmere	Steeple	66	51	57	SE	319625			197216		
Dover Court	Harkstead	45	2	45	NW	269208	269208	E	182770	182769	N
Rushmere	Steeple	2	41	15	SW	269209			182768		
Dover Court	Arwarton	24	33	8	NW	277899	277902	E	180550	180547	N
Tattingstone	Steeple	72	10	38	SE	277905			180544		
Tattingstone	Bradfield	6	0	38	SE	252552	252551	E	168520	168521	N
Arwarton	Steeple	64	37	22	SW	252550			168523		
Falkenham	Orford Steeple	51	16	53	NE	345336	345342	E	228887	228881	N
Rushmere		81	43	43	NE	345349			228876		
Falkenham	Nacton Steeple	83	34	7	NW	277115	277115	E	197000	196998	N
Rushmere		16	32	17	SE	277115			196997		
Dover Court	Capel Steeple	63	18	59	NW	233984	233986	E	193474	193468	N
Stoke		80	25	43	NE	233988			193462		
Stoke	Great Horks-	22	8	14	SW	195997	195997	E	175309	175309	N
Great Tey	ley Steeple	51	49	14	NE	195997			175310		
Great Horksley	Mount Bures	87	34	46	NW	174196	174195	E	176230	176230	N
Stoke	Steeple	66	32	14	SW	174194			176231		
Rushmere	Hollesley	82	8	17	SE	322258	322258	E	210952	210953	N
Dover Court	Steeple	42	38	33	NE	322258			210955		
Rushmere	Shottisham	82	14	7	SE	311711	311720	E	212477	212477	N
Dover Court	Steeple	32	57	53	NE	311729			212477		
Woodbridge	Felixstow Sig-	16	45	47	SE	309444	309444	E	181100	181102	N
Dover Court	nal Staff	64	33	24	NE	309444			181104		

* Finton, by mistake, in the former part of this Survey.

Names of stations.		Bearings.				Distance from meridian.	Mean.		Distance from perpendicular.	Mean.	
		°	′	″		Feet.	Feet.		Feet.	Feet.	
Woodbridge	Bawdsey Signal Staff	33	7	47	SE	318758	318757	E	191712	191714	N
Dover Court		56	58	8	NE	318757			191716		
Butley	Rendlesham Steeple	59	42	17	NW	313767	313761	E	239061	239058	N
Woodbridge		57	12	43	NE	313755			239055		
Dover Court	Kesgrave Steeple	6	7	41	NW	278145	278145	E	216905	216904	N
Rushmere		31	3	47	SE	278146			216903		
Dover Court	Waldringfield Steeple	20	4	29	NE	298893	298901	E	211282	211281	N
Rushmere		76	25	37	SE	298900			211282		
Dover Court	Wherstead Steeple	37	5	51	NW	258996	258995	E	200845	200844	N
Kesgrave		50	0	49	SW	258995			200843		
Capel Steeple	Hintlesham Steeple	3	26	17	NE	235016	235017	E	210623	210620	N
Stoke		56	11	25	NE	235019			210618		
Stoke	Bildestone Steeple	1	24	50	NE	202169	202168	E	230147	230147	N
Lavenham		89	50	0	SE	202168			230147		
Stoke	Aldham Steeple	35	18	30	NE	219654	219654	E	214079	214080	N
Bildeston		47	25	20	SE	219654			214081		
Naughton	Hadleigh Steeple	1	12	40	SE	214492	214565	E	207881	207823	N
Lavenham		58	15	30	SE	214639			207766		
Naughton	Lindsey Steeple	49	42	50	SW	199105	199177	E	216365	216308	N
Lavenham		56	15	10	SE	199249			216251		
Stoke	Newton Steeple	51	25	50	NW	179897	179897	E	204850	204850	N
Lavenham		3	29	40	SE	179897			204850		
Stoke	Grotton Steeple	24	24	50	NW	193001	193001	E	205823	205823	N
Newton		85	45	10	NE	193001			205823		
Bulmer	Waldingfield Steeple	62	39	10	NE	177687	177690	E	213569	213540	N
Glemsford		58	26	20	SE	177693			213511		
Glemsford	Acton Steeple	59	48	35	SE	171295	171295	E	218047	218047	N
Lavenham		30	5	35	SW	171296			218047		
Bulmer	Beauchamp Ch. St. Paul's	51	50	10	NW	140480	140478	E	213137	213135	N
Lavenham		65	43	20	SW	140476			213134		
Lavenham	Hedingham Castle	45	20	20	SW	136127	136128	E	188492	188492	N
Toppesfield		70	0	30	SE	136129			188492		
Lavenham	Ridgewell Steeple	66	27	10	SW	121213	121213	E	205317	205316	N
Bulmer		84	1	50	NW	121214			205316		
Naughton	Langham Steeple	2	52	7	SE	216543	216610	E	179186	179127	N
Stoke		60	22	7	SE	216690			179069		
Stoke	Earles Colne Steeple	60	43	14	SW	159472	159471	E	164565	164565	N
St. Mary's, Colch.		72	35	26	NW	159471			164565		
St. Mary's	West Bergholt Steeple	51	8	42	NW	189552	189553	E	161393	161393	N
Great Tey		70	49	58	NE	189554			161393		
Danbury	Braxted Steeple	36	18	45	NE	155021	155021	E	120989	120988	N
Great Tey		23	16	5	SW	155022			120988		
Braxted	Kelverdon Steeple	11	32	29	NE	157104	157104	E	131184	131185	N
Great Tey		27	53	29	SW	157104			131186		
Great Tey	Messing Steeple	2	21	21	SE	170301	170301	E	132010	132009	N
Kelverdon		86	25	29	NE	170302			132009		
Great Tey	East Thorp	23	49	41	SE	175627	175627	E	140237	140236	N
Kelverdon		63	57	29	NE	175627			140236		

Names of stations.		Bearings.			Distance from meridian.	Mean.	Distance from perpendicular.	Mean.
		°	′	″	Feet.	Feet.	Feet.	Feet.
Tiptree	Witham Steep.	56	46	32 NW	143890	143888 E	120923	120927 N
Danbury		21	52	28 NE	143887		120932	
Tiptree	Tarling	75	58	23 NW	129390	129388 E	119511	119513 N
Danbury	Steeple	2	3	23 NW	129386		119516	
Pleshey	Felstead	13	41	16 NE	98214	98210 E	138616	138613 N
Danbury	Steeple	32	23	31 NW	98207		138611	
Pleshey	Great Leigh	81	44	16 NE	118041	118041 E	122359	122361 N
Felstead	Steeple	50	39	44 SE	118041		122363	
Pleshey	Great Baddow	33	23	53 SE	114190	114191 E	87232	87229 N
Danbury	Steeple	88	27	53 SW	114191		87226	
Pleshey	Chelmsford	29	41	53 SE	107349	107349 E	94258	94263 N
Danbury	Steeple	74	2	1 NW	107350		94288	
Danbury	Whittle	82	41	29 NW	97251	97250 E	91931	91936 N
Pleshey	Steeple	8	41	33 SE	97249		91942	
Gallywood	Roxwell	43	43	26 NW	86985	86986 E	99902	99903 N
Pleshey	Steeple	18	43	10 SW	86987		99905	
Gallywood	White Roding	51	38	40 NW	59967	59967 E	116602	116604 N
Pleshey	Steeple	86	15	55 SW	59967		116606	
Frierning	Doddinghurst	78	55	28 SW	67638	67644 E	69301	69304 N
Southweald	Steeple	20	48	47 NE	67651		69308	
Southweald	Theydon	54	3	14 NW	36122	36125 E	70851	70859 N
Epping Mill	Mount Steep.	65	23	14 SE	36128		70867	
Southweald	Navestock new	4	50	14 NW	60484	60485 E	62217	62221 N
Theydon Mount	Mill	70	29	14 SE	60487		62226	
Southweald	Theydon Gar-	59	21	14 NW	29374	29363 E	71511	71461 N
Theydon Mount	non Steeple	85	20	14 NW	29351		71411	
Theydon Mount	Havering	16	39	44 SE	42172	42177 E	50654	50654 N
Theydon Garnon	Steeple	31	42	14 SE	42183		50654	
Severndroog	Cupola at	10	24	56 NW	4584	4584 E	47329	47331 N
Highbeech	Woodford	10	4	28 SW	4584		47333	
Southweald	Ruins near	69	1	52 SW	13358	13357 E	34223	34225 N
Highbeech	Ilford	9	1	28 SE	13356		34227	
Nasing	Hunsdon	5	57	9 NE	12836	12839 E	115758	115758 N
Berkhampstead Gazebo	Steeple	71	6	45 NE	12843		115758	
Huntsdon	Broxbourn	40	38	9 SW	3021	3020 W	97376	97377 N
Nasing	Steeple	88	37	51 NW	3020		97378	
Danbury	Willingale	81	23	51 NW	70724	70725 E	96710	96713 N
Hatfield Oak	Spain Steeple	26	38	16 SE	70726		96716	
Danbury	Braintree	5	52	1 NW	124508	124510 E	146272	146266 N
Felstead	Steeple	73	47	14 NE	124513		146261	
Hatfield Oak	Harlow Steep.	52	44	34 SW	33842	33846 E	111140	111081 N
Berkhampstead Gazebo		81	29	13 NE	33850		111023	
Hatfield Oak	Sabridgeworth	74	50	17 SW	34982	34959 E	121958	122044 N
Nasing	Steeple	43	48	2 NE	34936		122136	

Names of stations.		Bearings.				Distance from meridian.	Mean.		Distance from perpendicular.	Mean.	
		°	′	″		Feet.	Feet.		Feet.	Feet.	
Albury -	Bishop Stortford Steeple	54	29	24	SE	35934	35929	E	143459	143454	N
Henham -		40	22	56	SW	35925			143450		
Stanstead Mountfitchet Steeple	Farnham Steeple	79	27	59	NW	34427	34425	E	154725	154723	N
Henham -		69	37	6	SW	34423			154721		
Albury -	Stanstead Mountfitchet Steeple	84	18	27	SE	47531	47526	E	152294	152289	N
Henham -		29	34	6	SW	47522			152285		
Henham -	Meesdon Mill	69	20	30	NW	19158	19162	E	180479	180483	N
Albury -		1	6	40	NW	19167			180488		
Rickling -	Newport Steeple	41	50	8	NE	48409	48408	E	185013	185010	N
Elmdon -		45	1	52	SE	48407			185007		
Balsham -	ShudyCamps*	25	17	50	SE	82115	82114	E	217814	217818	N
Elmdon -		74	57	40	NE	82114			217822		
Shudy Camps	Ashdon Steeple	55	23	10	SW	68848	68848	E	208661	208660	N
Balsham -		5	49	20	SW	68848			208659		

Bearings of the principal Stations of the western Parts of Kent, &c. &c.

Frant -	Sevenoaks Mill	19	20	53	NW	42962	42961	E	83270	83270	S
Botley Hill -		76	21	7	SE	42961			83271		
Frant - -	Chiddingstone Steeple	41	38	3	NW	33852	33850	E	106413	106403	S
Sevenoaks Mill		21	31	57	SW	33848			106394		
Frant -	Mount Sion	6	35	46	NW	55693	55691	E	80967	80962	S
Chiddingstone		40	38	14	NE	55690			80957		
Frant -	East Peckham Steeple	24	52	44	NE	87147	87146	E	84966	84963	S
Mount Sion		82	45	16	SE	87145			84960		
East Peckham	Tudeley Steeple	32	3	44	SW	73465	73465	E	106804	106803	S
Mount Sion		34	31	16	SE	73465			106803		
Sevenoaks -	Seal Chart	65	21	5	NE	59674	59673	E	75602	75601	S
Botley Hill		87	22	55	SE	59673			75601		
Sevenoaks	Tunbridge Steeple	47	49	55	SE	63789	63789	E	102135	102135	S
Seal Chart -		8	48	55	SE	63789			102135		
Seal Chart	Otford Mount	36	37	55	NW	47503	47503	E	59233	59233	S
Sevenoaks -		10	42	5	NE	47503			59234		
Norwood -	Station, Well Hill	68	30	7	SE	34094	34093	E	45635	45636	S
Severndroog		25	45	47	SE	34093			45638		
Well Hill -	Crayford Steeple	9	14	45	NE	40174	40173	E	8287	8287	S
Severndroog		80	50	1	SE	40173			8288		
Crayford -	Ash Steeple	38	53	55	SE	68780	68780	E	43740	43741	S
Well Hill -		86	52	25	NE	68780			43742		
Gad's Hill -	Northfleet Steeple	69	4	54	NW	76615	76614	E	12548	12548	S
Halstow -		84	36	53	SW	76614			12549		
Sheppey -	Hern Hill	48	45	30	SE	220216	220216	E	60633	60633	S
Frinstead -		80	51	12	NE	220217			60633		
Hern Hill -	Stockbury Steeple	85	47	30	NW	148806	148806	E	55379	55379	S
Sheppey -		39	32	30	SW	148806			55379		
Sheppey -	Frinstead	15	23	54	SW	—	163132	E	—	698248	S

* Shady Camps, by mistake, in the former part of this Survey.

Bearings of the secondary and inferior Objects, &c. of the western Parts of Kent.

Names of stations.		Bearings.	Distance from meridian.	Mean.		Distance from perpendicular.	Mean.	
		° ′ ″	Feet.	Feet.		Feet.	Feet.	
Frant - -	Bidborough Steeple	16 51 0 NW	54785	54786	E	113503	113506	S
Botley -		53 21 9 SE	54787			113496		
Frant -	Station near Bidborough Church	20 46 3 NW	52687	52685	E	113000	112995	S
Chiddingstone		70 43 3 SE	52684			112991		
Botley - -	Tree near Kibben's Cross	57 9 11 SE	83513	83515	E	126687	126689	S
Frant -		60 56 36 NE	83518			126691		
Frant - -	Cowden Steeple	67 18 3 NW	23647	23679	E	122273	122270	S
Station near Bidborough Church		72 17 27 SW	23712			122268		
Station near Bidborough -	Leigh Steeple	15 18 3 NW	49720	49731	E	102152	102164	S
Mount Sion		15 39 57 SW	49742			102175		
Frant - -	Station, Ide Hill	31 32 33 NW	29621	29616	E	85152	85142	S
Chiddingstone		11 16 33 NW	29611			85132		
Ide Hill -	Eatonbridge* Steeple	38 26 27 SW	15562	15569	E	102848	102842	S
Chiddingstone		78 58 33 NW	15557			102839		
Mount Sion	Hadlow Steeple	62 9 16 SE	78053	78055	E	92775	92777	S
Peckham -		49 18 44 SW	78058			92779		
Otford Mount	Sundrich Steeple	49 33 5 SW	29901	29901	E	74241	74241	S
Seal Chart -		87 22 55 NW	29901			74241		
Well Hill -	Ketson Common Windmill	86 10 47 NW	7615	7614	E	43868	43867	S
Norwood -		54 24 45 SE	7614			43867		
Well Hill -	Hayes Common Flagstaff	82 24 47 NW	6068	6068	E	41903	41904	S
Severndroog		11 53 13 SW	6068			41905		
Hayes Common	Addington Common Flagstaff	84 34 43 SW	11919	11912	E	43611	43608	S
Norwood -		21 16 47 SE	11906			43606		
Well Hill -	Station, Farnborough	84 46 47 NW	22492	22491	E	44576	44576	S
Severndroog		11 47 47 SE	22491			44577		
Farnborough	St. Mary's Cray	15 41 13 NE	26553	26553	E	30116	30116	S
Well Hill -		25 54 47 NW	26554			30116		
Well Hill -	Halstead Steeple	31 47 27 SW	29536	29535	E	52990	52990	S
Norwood -		59 50 3 SE	29535			52990		
Norwood -	Bromley Steeple	85 1 7 SE	3304	3303	E	26574	26573	S
Severndroog		25 29 23 SW	3303			26572		
Bromley -	Hayes Steeple	6 39 47 SE	4441	4447	E	36311	36318	S
Well Hill -		72 33 47 NW	4453			36326		
Bromley -	Lewisham Steeple	19 48 37 NW	3352	3353	W	8096	8096	S
Severndroog		76 57 23 SW	3354			8097		
Chiselhurst -	New Cross	51 47 59 NW	9490	9490	W	3550	3550	S
Severndroog		88 43 59 NW	9491			3550		

* Edenbridge, by mistake, in the former part of this Survey.

Names of stations.		Bearings.	Distance from meridian.	Mean.		Distance from perpendicular.	Mean.	
		° ′ ″	Feet.	Feet.		Feet.	Feet.	
Severndroog	Eastcombe Point	50 43 59 NW	86	86	E	7332	7332	S
New Cross -		41 21 1 NE	87			7332		
Severndroog	Woolwich Steeple	1 4 59 NW	13855	13853	E	5556	5556	N
Eastcombe Point		82 38 59 SE	13852			5557		
Crayford -	Bexley Steeple	41 21 39 SW	35426	35425	E	13679	13680	S
Severndroog		65 48 31 SE	35425			13681		
Well Hill -	Charlton Farm	52 33 15 NW	15965	15965	E	31752	31751	S
Crayford -		45 53 45 SW	15965			31751		
Crayford -	Dartford Brent Mill	69 26 13 SE	54059	54060	E	13496	13496	S
Ash - -		25 57 6 NW	54061			13497		
Ash - -	HartleySteeple	29 56 5 NE	72706	72711	E	36922	36920	S
Northfleet -		9 16 55 SW	72716			36918		
Ash - -	Ridley Steeple	64 4 45 SE	73446	73446	E	46009	46009	S
Northfleet -		5 32 35 SW	73446			46010		
Gads Hill -	Cliff Steeple	24 3 15 NE	113741	113741	E	5396	5396	S
Gravesend -		70 49 7 NE	113742			5397		
Halstow -	Gravesend Steeple	84 19 23 SW	84513	84517	E	12033	12058	S
Gravesend -		6 19 23 NW	84518			12082		
Halstow -	Chalk Steeple	71 45 9 SW	96111	96110	E	18464	18462	S
Gravesend -		74 54 24 SE	96109			18460		
Gads Hill -	Guard Room, Lower Hope Point	3 41 11 NE	107247	107247	E	1895	1894	N
Gravesend -		52 13 26 NE	107247			1894		
Gads Hill -	Flagstaff, Tilbury Fort	52 58 28 NW	86260	86260	E	9039	9040	S
Gravesend -		12 6 7 NE	86260			9041		
Sheppey -	Rainham Steeple	62 21 39 SW	139485	139484	E	41373	41372	S
Gads Hill -		62 21 33 SE	139483			41372		
Halstow -	Swanscombe Spire	84 51 25 SW	70463	70463	E	12880	12879	S
Gads Hill -		72 59 24 NW	70464			12879		
Halstow -	Southfleet Steeple	75 19 30 SW	73187	73187	E	22234	22234	S
Gravesend -		59 50 13 SW	73187			22234		
Gravesend -	Shorn Mill	61 26 17 SE	98017	98025	E	22580	22584	S
Halstow -		64 12 53 SW	98034			22586		
Sheppey -	Gillingham Steeple	78 54 49 SW	128724	128724	E	31425	31426	S
Halstow -		0 45 32 SW	128725			31427		
Gillingham -	St. James's, Isle of Grain	54 20 32 NE	163871	163871	E	6210	6209	S
Sheppey -		37 57 19 NW	163871			6209		
Sheppey -	Friendsbury Steeple	87 3 26 NW	115632	115631	E	18991	18991	S
Gads Hill -		65 10 37 NE	115631			18991		
Sheppey -	Star Inn	71 18 17 SW	128656	128656	E	38221	38221	S
Halstow -		0 43 10 SW	128656			38222		
Sheppey -	Upper Bell Inn	62 18 51 SW	116532	116532	E	53454	53441	S
Halstow -		15 16 0 SW	116533			53431		
Sheppey -	Upchurch Steeple	63 9 35 SW	148260	148250	E	36283	36266	S
Gads Hill -		73 30 36 SE	148240			36251		
Frinstead -	Hucking Spire	77 54 35 NW	147823	147822	E	66545	66545	S
Sheppey -		32 37 45 SW	147822			66545		

Names of stations.		Bearings.	Distance from meridian	Mean.		Distance from perpendicular.	Mean.	
		° ′ ″	Feet.	Feet.		Feet.	Feet.	
Hern Hill -	East Church	34 30 32 NW	196669	196678	E	26383	26376	S
Sheppey -		78 12 36 SE	196688			26369		
East Church -	Milton Steeple	57 27 7 SW	169440	169445	E	43761	43758	S
Sheppey -		17 29 46 SW	169450			43754		
Milton -	Iwade Steeple	14 54 14 NW	165705	165702	E	29703	29685	S
Sheppey -		54 26 16 SW	165700			29667		
Hern Hill -	Witchling Steeple	73 23 12 SW	170790	170789	E	75380	75380	S
Frinstead -		54 2 13 SE	170789			75380		
Hern Hill -	Sheldwich Steeple	56 6 30 SW	202302	202291	E	72667	72675	S
Sheppey -		27 12 48 SE	202280			72682		
Sheldwich -	Queenborough Steeple	31 53 48 NW	170208	170213	E	21124	21128	S
Sheppey -		80 52 4 NW	170219			21133		
Halstow -	St. Mary's Steeple	77 55 24 NE	135978	135977	E	6123	6123	S
Hadleigh -		4 8 17 SE	135977			6123		
Hern Hill -	Feversham Steeple	77 56 30 NW	204931	204930	E	57368	57368	S
Sheppey -		39 6 8 SE	204930			57368		

Latitudes and Longitudes of the preceding Stations and Objects, referred to the Meridian of Greenwich.

Names of stations.	Latitudes.	Longitudes.	Names of stations.	Latitudes.	Longitudes.
	° ′ ″	° ′ ″		° ′ ″	° ′ ″
Highbeech -	51 39 42,5	0 2 8,3 E	Tiptree - -	51 47 2,2	0 41 17,8 E
Station, Hampstead -	51 33 55,4	0 10 28,0 W	Tillingham -	51 41 52,7	0 52 52,9 E
New Station, Wrotham -	51 18 55,5	0 18 49,2 E	Peldon -	51 58 50,3	0 53 11,4 E
Station, Gravesend - -	51 26 5,9	0 22 15,6 E	Flagstaff, St. Osyth Priory -	51 47 57,9	1 4 25,7 E
Langdon Hill	51 33 12,5	0 25 22,1 E	Great Tey -	51 53 53,2	0 44 49,9 E
Hadleigh -	51 32 52,5	0 35 7,4 E	Stoke -	51 59 20,4	0 53 22,6 E
Halstow - -	51 27 20,3	0 33 50,7 E	Thorp -	51 51 23,2	1 9 38,3 E
Gads Hill -	51 24 43,8	0 27 40,2 E	Little Bentley	51 52 56,3	1 4 49,7 E
Sheppey -	51 24 23,2	0 46 11,5 E	Dover Court	51 55 59,1	1 15 6,1 E
Rayleigh -	51 35 17,0	0 36 29,2 E	St. Mary's, Colchester -	51 53 17,7	0 53 33,7 E
Prittlewell -	51 32 56,2	0 42 16,2 E	West Mersea	51 46 29,8	0 54 33,3 E
Canewdon -	51 37 3,4	0 46 15,5 E	Little Bromley	51 54 43,4	0 39 16,8 E
Staff, Sheerness	51 11 21,6	0 44 25,7 E	Tattingstone	51 59 39,4	0 41 55,5 E
Danbury -	51 42 59,3	0 34 26,0 E	Rushmere -	52 4 7,3	1 12 0,8 E
Frierning -	51 40 32,5	0 22 7,0 E	Falkenham -	51 56 2,2	1 20 4,0 E
Purfleet Cliff -	51 28 59,4	0 14 9,9 E	Woodbridge -	52 5 34,6	1 18 36,8 E
South End -	51 32 4,4	0 42 15,5 E	Butley -	52 5 53,7	1 27 39,8 E
Staff, Shoeburyness -	51 31 19,1	0 47 12,6 E	Orford Light House -	52 5 0,1	1 34 13,6 E
			Otley -	52 8 54,1	1 13 2,5 E

Names of stations.	Latitudes.			Longitudes.			
	°	′	″	°	′	″	
Henley	52	7	2,9	1	8	57,2	E
Copdock	52	1	51,9	1	5	13,2	E
Naughton	52	6	3,5	0	56	56,7	E
Twinstead	51	59	48,4	0	42	47,2	E
Lavenham	52	6	19,1	0	47	27,0	E
Bulmer	52	1	41,5	0	41	8,6	E
Glemsford	52	6	8,8	0	40	36,4	E
Toppesfield	52	0	28,1	0	32	4,1	E
Gallywood Common	51	41	51,8	0	27	47,7	E
Pleshey	51	48	8,0	0	24	40,8	E
High Easter	51	48	26,9	0	20	56,1	E
Hatfield Oak	51	49	35,5	0	14	37,4	E
Beauchamp Roding	51	45	48,9	0	17	8,8	E
Thaxted	51	57	13,1	0	20	32,7	E
Southweald	51	37	17,4	0	16	8,1	E
Brentwood	51	37	11,8	0	18	9,5	E
New Station, Highbeech	51	39	42,9	0	2	1,1	E
Epping Mill	51	41	23,3	0	5	43,8	E
Berkhampstead Gazebo	51	45	23,0	0	7	23,3	E
Henham on the Mount	51	56	1,7	0	14	45,7	E
Thorley	51	50	53,8	0	8	33,2	E
Elmdon	52	2	7,3	0	8	3,8	E
Rickling	51	57	40,3	0	10	51,2	E
Albury	51	54	8,1	0	5	12,4	E
Balsham	52	7	56,1	0	19	9,6	E
Babraham Mount	51	32	38,5	0	12	52,1	E
Triplow	52	6	5,0	0	6	21,3	E
Hornchurch	51	33	37,3	0	13	36,1	E
Barking	51	32	7,5	0	4	36,5	E
Westham	51	32	10,6	0	0	35,7	E
Chigwell	51	37	27,2	0	4	53,4	E
Billericay	51	37	32,5	0	25	6,5	E
Public House	51	30	56,3	0	5	59,6	E
Rainham	51	31	5,7	0	11	29,0	E
Belvidere	51	29	11,7	0	9	55,3	E
Valence Tree	51	33	39,6	0	8	14,2	E
Cold Harbour	51	29	16,5	0	11	19,3	E
Chadwell	51	28	53,4	0	22	10,9	E
West Tilbury	51	28	26,1	0	23	27,7	E
Greys Steeple	51	29	1,7	0	18	30	E
West Thurrock	51	28	20,0	0	17	34,2	E
Northfleet	51	26	34,6	0	20	5,4	E
Horndon	51	31	25,7	0	24	17,8	E
Flagstaff, East Tilbury	51	27	36,0	0	25	49,2	E
Fobbing Steeple	51	31	39,8	0	28	30,7	E
Thundersley	51	34	7,4	0	34	13,9	E
Leigh	51	32	28,7	0	39	12,6	E
Little Wakering	51	33	38,0	0	47	18,3	E
Bank Flagstaff	51	33	26,0	0	50	37,5	E
Foulness Chapel	51	36	5,7	0	53	28,1	E
Tillingham Grange Signal Staff	51	40	6,2	0	55	15,2	
Flagstaff, Bradwell Point	51	44	5,0	0	56	19,8	E
Brightlingsea	51	49	42,3	1	0	39,5	E
Tolleshunt Major	51	45	57,2	0	45	49,5	E
Tolesbury	51	45	27,6	0	49	54,9	E
Althorn	51	39	23,8	0	45	26,8	E
Burnham	51	38	17,7	0	48	48,2	E
Rettenden	51	38	5,2	0	33	22,4	E
Runwell	51	37	15,6	0	31	53,4	E
Great Burstead	51	36	13,6	0	25	31,2	E
East Hanningfield	51	40	11,4	0	33	10,2	E
Hockley	51	36	34,9	0	38	6,3	E
Stow, St. Mary's	51	39	47,4	0	38	57,1	E
Stock Steeple	51	39	40,0	0	26	19,3	E
Southminster	51	39	42,7	0	49	44,0	E
Layer Marney	51	49	13,7	0	47	42,6	E
St. Osyth Point Signal Staff	51	47	3,0	1	8	46,5	E
Great Clackton Signal Staff	51	48	12,1	1	12	5,9	E
Frinton Steeple	51	30	26,8	1	12	28,4	E
Flagstaff, Frinton	51	50	17,8	1	15	33,4	E
Walton Tower	51	51	51,2	1	17	6,8	E
Cupola, Languard Fort	51	56	18,5	1	19	3,9	E
Ardleigh	51	55	34,3	1	59	1,5	E
Frating	51	51	38,2	1	1	12,8	E
Thorrington	51	51	10,0	1	3	19,4	E
Kirby	51	51	9,3	1	13	7,4	E
Brantham	51	57	56,4	1	4	15,5	E
Harwich	51	56	43,3	1	17	7,8	E
Little Oakley	51	54	37,3	1	12	42,9	E
Bawdsey	52	0	38,8	1	24	52,1	E
Harkstead	51	58	20,2	1	11	25,2	E
Arwarton	51	57	56.8	1	13	42,9	E
Bradfield	51	56	2,2	1	6	56,5	E
Orford	52	5	40,9	1	31	54,2	E

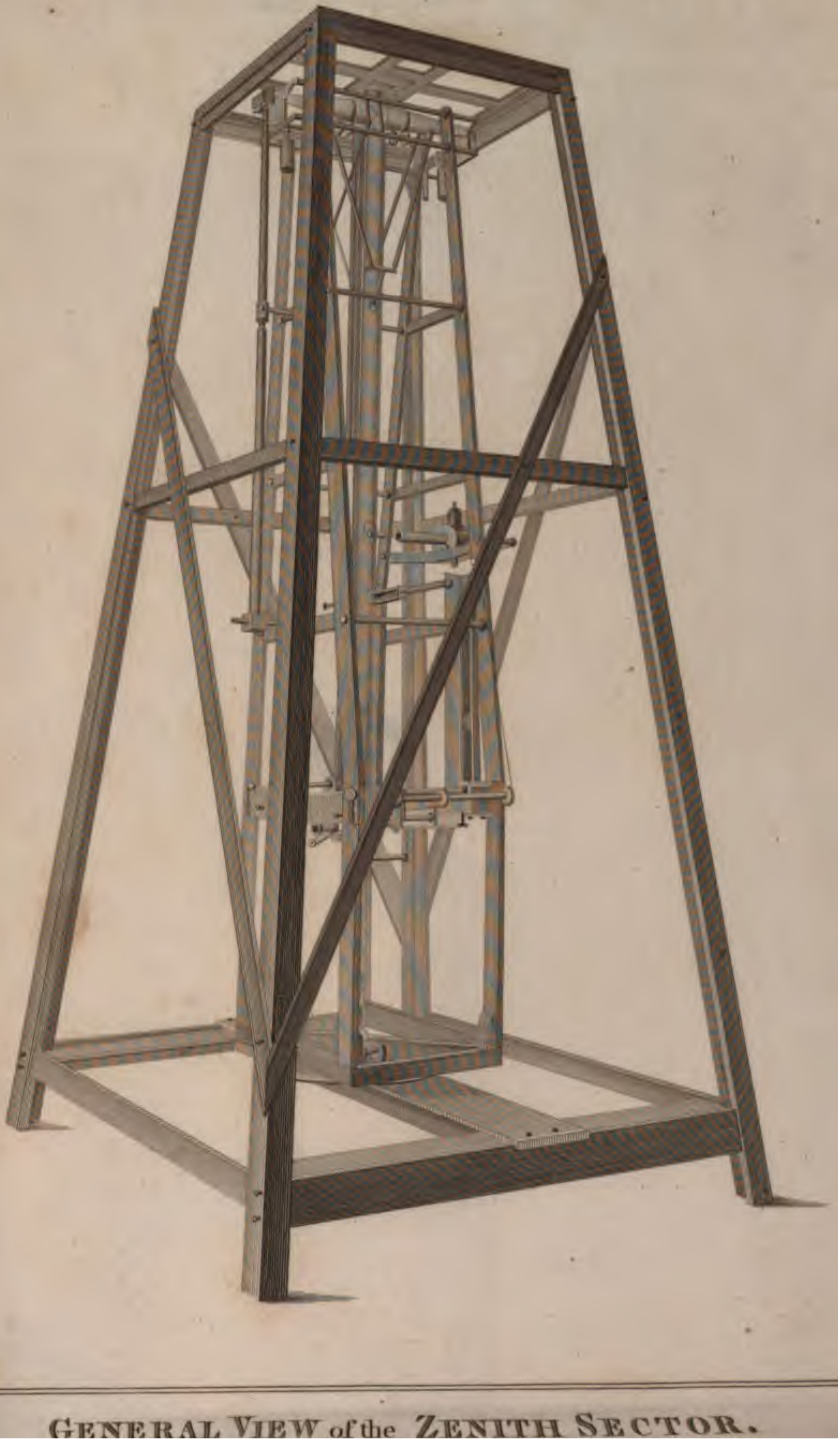
Names of stations.	Latitudes.			Longitudes.			
	°	′	″	°	′	″	
Nacton -	52	0	34,5	1	13	34,6	E
Capel -	52	0	10,6	1	2	6,9	E
Great Horksley	51	57	16,5	0	51	58,4	E
Mount Bures -	51	57	27,8	0	46	11,7	E
Hollesley -	52	2	48,7	1	25	38,4	E
Shottisham -	52	3	5,2	1	22	50,8	E
Felixstow Staff	51	57	56,9	1	22	5,1	E
Bawdsey Signal Staff -	51	59	39,8	1	24	36,6	E
Rendlesham -	52	7	27,2	1	23	31,5	E
Kesgrave -	52	7	14,9	1	14	2,2	E
Waldringfield -	51	56	56,1	1	19	26,0	E
Whertstead -	52	1	19,6	1	8	47,1	E
Hintlesham -	52	2	59,4	1	2	27,3	E
Bildestone -	52	1	50,5	0	53	40,0	E
Aldham -	52	5	35,5	0	58	23,1	E
Hadleigh -	52	2	34,5	0	57	0,7	E
Lindsey -	52	5	40,5	0	52	58,9	E
Newton -	52	2	9,1	0	47	47,4	E
Grotton -	52	2	23,6	0	32	21,1	E
Waldingfield -	52	3	35,1	0	47	13,7	E
Acton -	52	3	31,2	0	45	31,7	E
Beauchamp -	52	3	34,4	0	37	20,2	E
Hedingham Castle -	51	59	35,6	0	36	7,6	E
Ridgewell -	52	2	18,8	0	32	12,1	E
Langham -	51	57	51,6	0	57	28,1	E
Earles Colne	51	55	34,2	0	42	15,6	E
West Bergholt	51	55	0,1	0	50	13,3	E
Braxted -	51	48	25,5	0	40	58,4	E
Kelvedon -	51	50	5,5	0	41	33,0	E
Messing -	51	50	12,5	0	45	2,5	E
East Thorp -	51	51	33,2	0	46	28,4	E
Witham -	51	53	34,4	0	38	6,1	E
Tarling -	51	48	13,0	0	34	11,7	E
Willingale Spain	51	44	31,6	0	18	40,0	E
Braintree -	51	52	33,7	0	32	57,5	E
Felstead -	51	51	23,3	0	25	59,2	E
Great Leigh -	51	48	41,8	0	31	7,8	E
Great Baddow	51	42	55,8	0	30	7,2	E
Chelmsford -	51	44	5,8	0	28	19,7	E
Whittle -	51	43	43,4	0	25	39,6	E
Roxwell -	51	45	2,3	0	22	57,7	E
White Roding	51	47	48,2	0	15	50,8	E
Doddinghurst	51	40	1,8	0	17	49,4	E
Theydon Mount	51	40	18,0	0	9	31,1	E
Navestock Mill	51	38	52,2	0	15	55,8	E
Theydon Garnon	51	40	23,6	0	7	44,2	E
Havering -	51	36	58,7	0	11	6,1	E
Cupola at Woodford -	51	36	26,5	0	1	12,3	E
Ruins near Ilford	51	34	17,3	0	3	30,7	E
Hunsdon -	51	47	40,8	0	3	23,5	E
Broxbourn -	51	44	30,8	0	0	47,8	E
Harlow -	51	46	54,4	0	5	38,4	E
Sabridgeworth	51	48	42,5	0	9	14,4	E
Bishop Stortford	51	52	13,4	0	9	30,5	E
Stanstead Mountfitchet -	51	53	40,2	0	12	35,1	E
Farnham -	51	54	4,4	0	9	7,0	E
Windmill, Meesdon -	51	58	18,5	0	5	4,9	E
Newport -	31	59	2,5	0	12	50,6	E
Shudy Camps	52	4	24,2	0	21	49,9	E
Ashdon -	52	2	54,7	0	18	17,6	E

West Parts of Kent.

Names of stations.	Latitudes.			Longitudes.			
Windmill, Sevenoaks -	51	14	58,5	0	11	12,9	E
Chiddingstone	51	11	10,6	0	8	49,6	E
Station, Mount Sion -	51	15	20,8	0	14	32,6	E
East Peckham	51	14	40,1	0	22	45,2	E
Tudeley - -	51	11	6,0	0	19	9,4	E
Seal Chart -	51	16	13,6	0	15	35,3	E
Tunbridge -	51	11	51,6	0	17	1,6	E
Otford Mount	51	18	55,3	0	12	25,3	E
Well Hill -	51	21	9,8	0	8	55,3	E
Crayford -	51	27	17,8	0	10	32,2	E
Ash - -	51	21	26,9	0	18	0,2	E
Bidborough -	51	10	0,3	0	14	6,8	E
Station near Bidborough Church	51	10	4,0	0	13	44,3	E
Tree near Kibben's Cross	51	7	48,8	0	21	45,1	E
Cowden Steeple	51	7	34,2	0	6	9,9	E
Leigh Steeple -	51	11	51,8	0	12	58,3	E
Ide Hill -	51	14	40,3	0	7	43,9	E
Eatonbridge -	51	10	6,0	0	4	3,3	E
Hadlow -	51	13	23,4	0	20	22,3	E
Sundrich -	51	16	27,7	0	8	8,7	E
Windmill, Ketson Common -	51	22	27,5	0	1	59,6	E
Hayes Common Flagstaff -	51	21	46,9	0	1	35,3	E

Names of stations.	Latitudes.	Longitudes.
	° ′ ″	° ′ ″
Addington Common Flagstaff	51 21 30,1	0 3 6,6 E
Farnborough	51 21 20,4	0 5 53,2 E
St. Mary's Cray	51 23 42,9	0 6 57,3 E
Halstead -	51 19 57,3	0 7 43,6 E
Bromley -	51 24 17,8	0 0 51,9 E
Hayes - -	51 22 41,3	0 1 9,8 E
Lewisham -	51 27 20,2	0 0 52,7 W
Station, New Cross	51 28 5,1	0 2 29,3 W
Eastcombe Point	51 29 52,2	0 0 1,3 E
Woolwich -	51 29 34,6	0 3 38,2 E
Bexley -	51 26 24,8	0 9 17,3 E
Charlton Farm	51 23 27,0	0 4 10,9 E
Dartford Brent Mill -	51 26 26,1	0 14 10,5 E
Hartley -	51 22 34,5	0 19 2,3 E
Ridley -	51 21 4,9	0 19 13,3 E
Cliff Steeple -	51 27 43,1	0 29 50,2 E
Gravesend Steeple	51 27 39,2	0 22 9,7 E
Chalk Steeple	51 25 35,4	0 25 11,5 E
Guard Room, Lower Hope Point -	51 28 55,3	0 28 8,6 E
Flagstaff, Tilbury Fort -	51 27 8,8	0 22 37,4 E
Rainham -	51 21 46,5	0 36 30,7 E
Southfleet -	51 24 59,4	0 19 10,7 E
Shorn Mill -	51 24 54,7	0 25 41,3 E
Gillingham -	51 23 27,4	0 37 3,0 E
St. James's, Isle of Grain -	51 27 36,9	0 54 6,9 E
Friendsbury	51 25 29,0	0 30 18,4 E
Star Inn -	51 22 18,5	0 37 1,1 E
Upper Bell Inn	51 19 49,2	0 30 28,9 E
Upchurch -	51 22 36,1	0 38 49,2 E
Bobbing -	51 21 13,6	0 42 34,0 E
Frinstead -	51 17 3,9	0 42 37,9 E
Hern Hill -	51 18 28,2	0 57 34,9 E
Stockbury -	51 19 27,6	0 38 55,3 E
Hucking -	51 17 37,6	0 38 38,3 E
East Church -	51 24 8,8	0 51 31,9 E
Milton -	51 21 20,3	0 44 21,0 E
Iwade -	51 23 39,5	0 43 24,4 E
Witchling -	51 16 8,4	0 44 36,8 E
Sheldwich -	51 16 31,6	0 52 51,4 E
Queenborough	51 25 3,4	0 44 36,5 E
St. Mary's -	51 27 34,4	0 53 40,1 E
Feversham -	51 19 2,3	0 53 35,7 E

Printed by W. Bulmer and Co.
Cleveland-Row, St. James's.



GENERAL VIEW of the ZENITH SECTOR.

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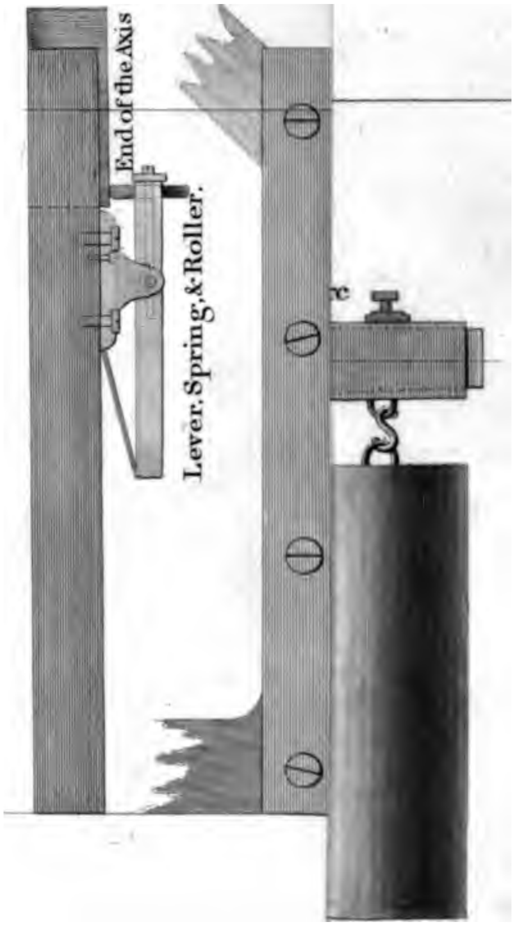
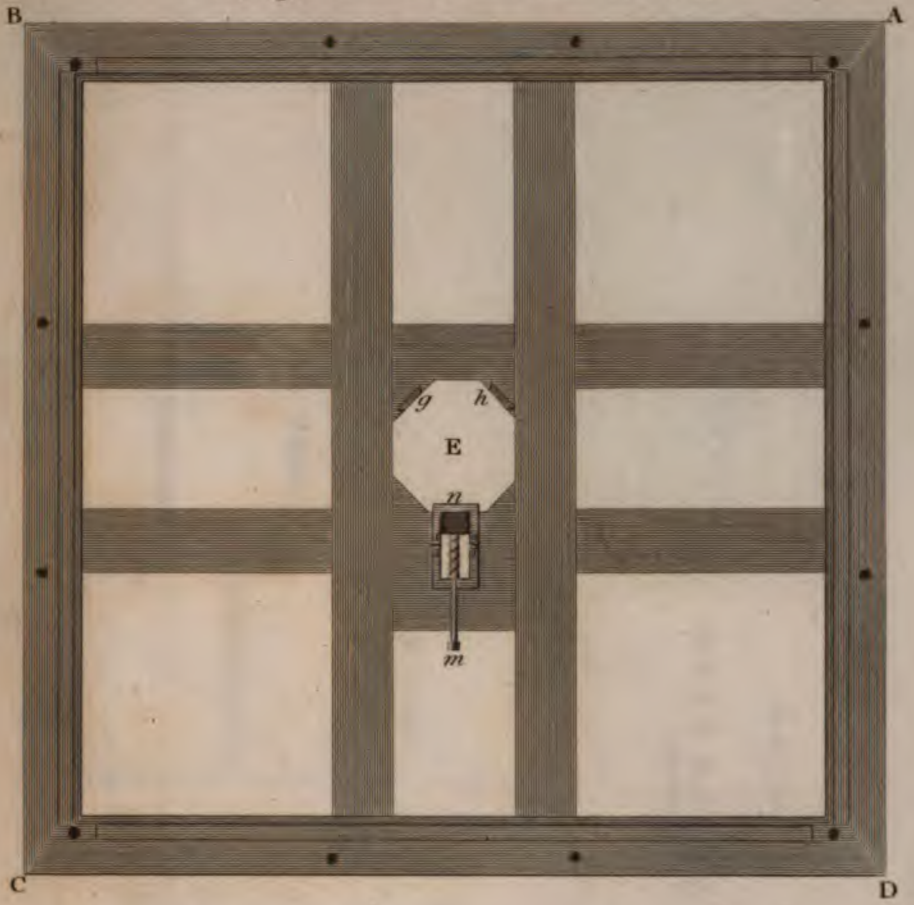
SECTION *of the* ZENIT

BIBLIOTHECA BODLEIANA

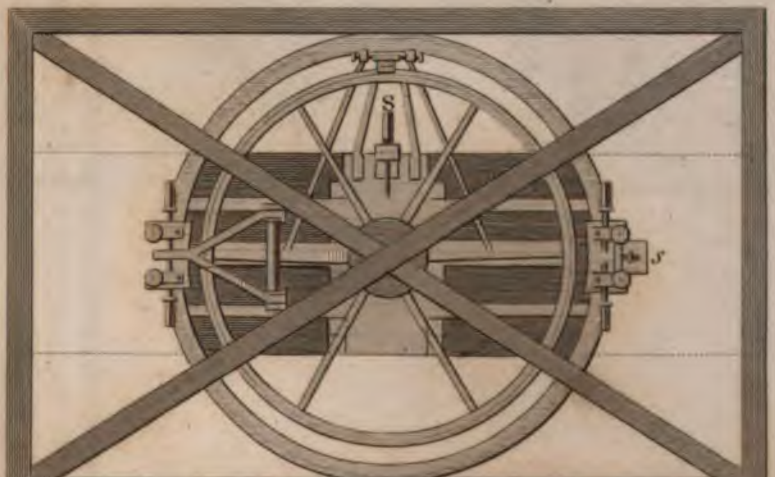


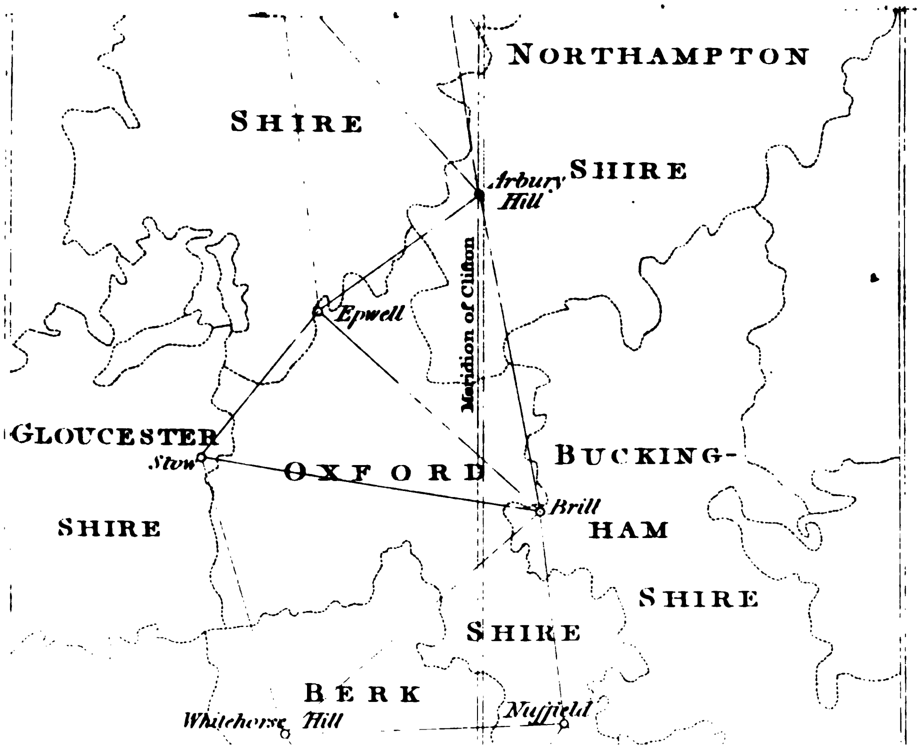
View of the

Top *of the External* Stand.



Bottom *of the Internal* Frame *resting on the* Azimuth Circle.




NORTHAMPTON
SHIRE
SHIRE
Arbury Hill
Epwell
Meridian of Clifton
GLOUCESTER
Stow
SHIRE
OXFORD
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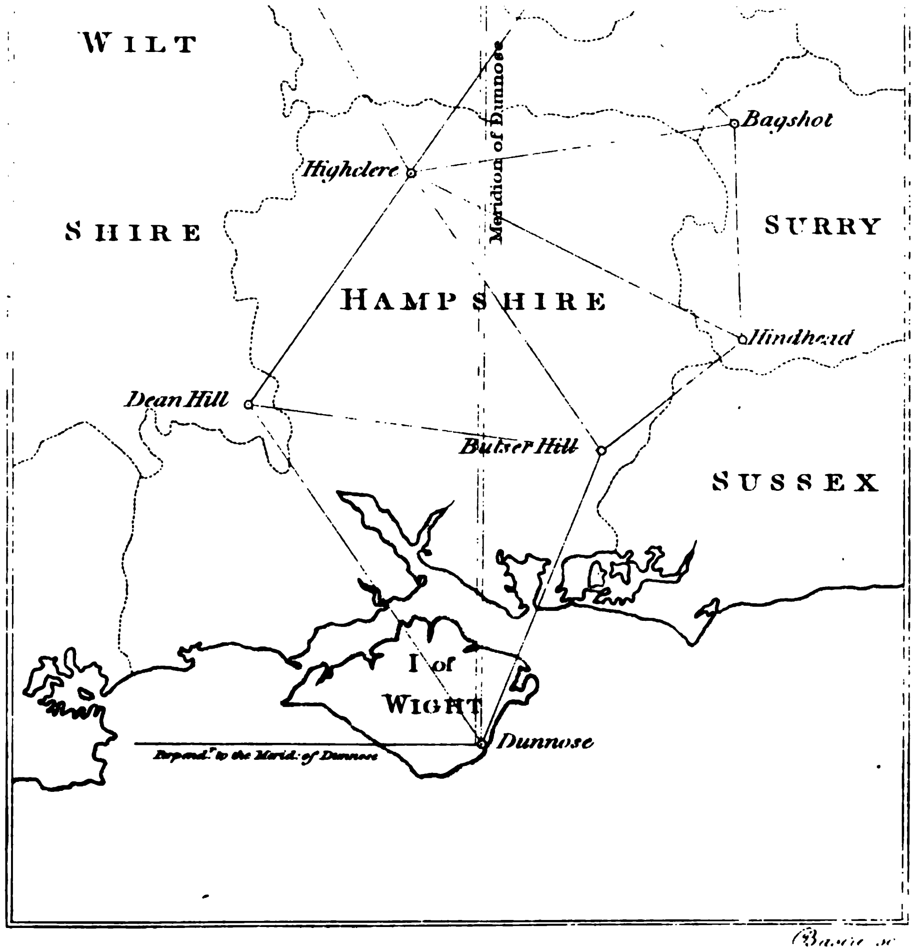
BUCKING-
HAM
SHIRE
Brill
BERK
Whitehorse Hill
Nuffield

Philos. Trans. MDCCCIII. Plate XVI. p



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TRIANGLES for

MDCCC. Plate XXXII. p.7

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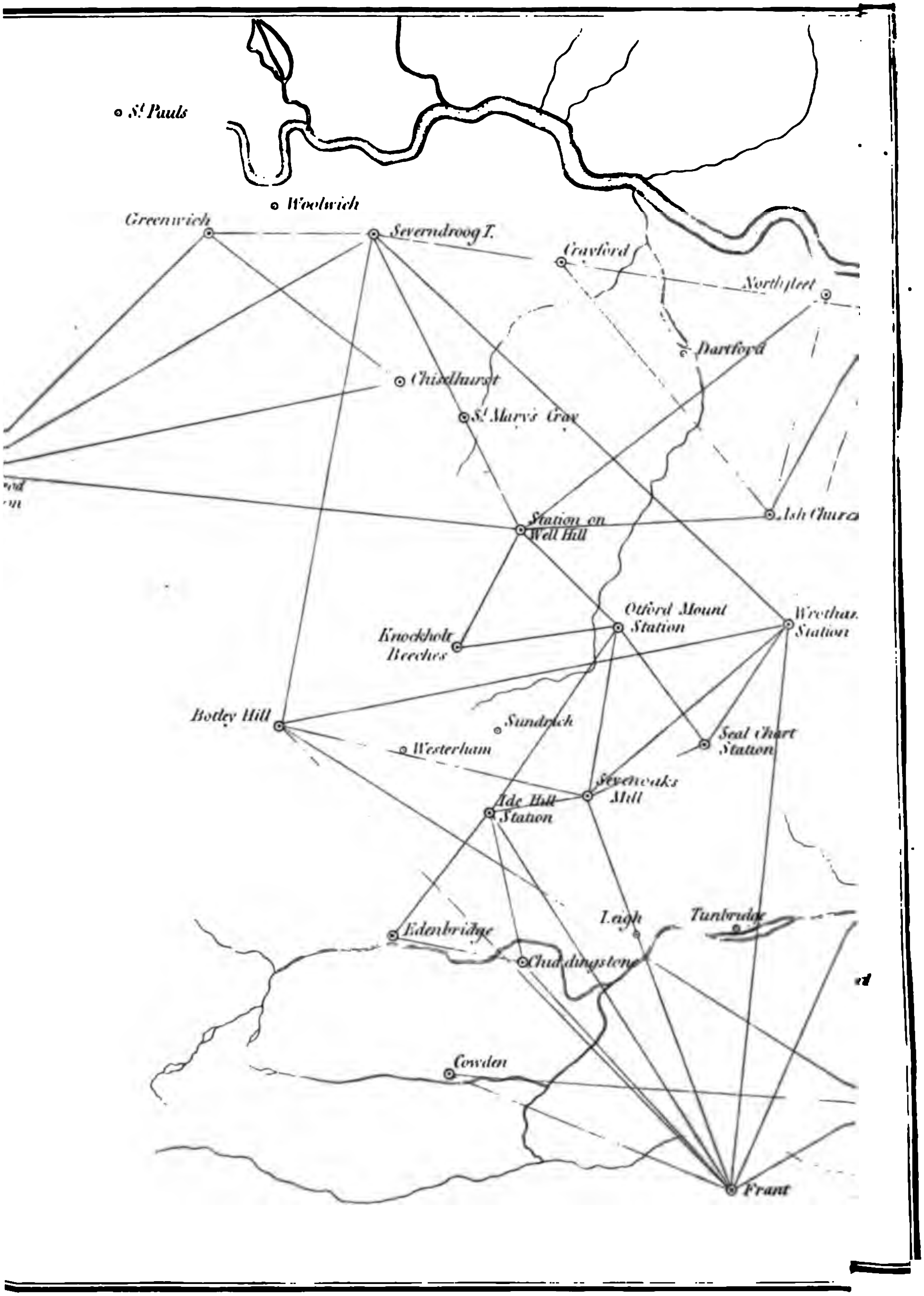

S.t Pauls
Woolwich
Greenwich
Severndroog T.
Crayford
Northfleet
Dartford
Chislehurst
S.t Mary's Cray
rod
on
Station on Well Hill
Ash Churc
Otford Mount Station
Wrethar Station
Knockholt Beeches
Botley Hill
Sundridge
Westerham
Seal Chart Station
Sevenoaks Mill
Ide Hill Station
Leigh
Tunbridge
Edenbridge
Chiddingstone
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Cowden
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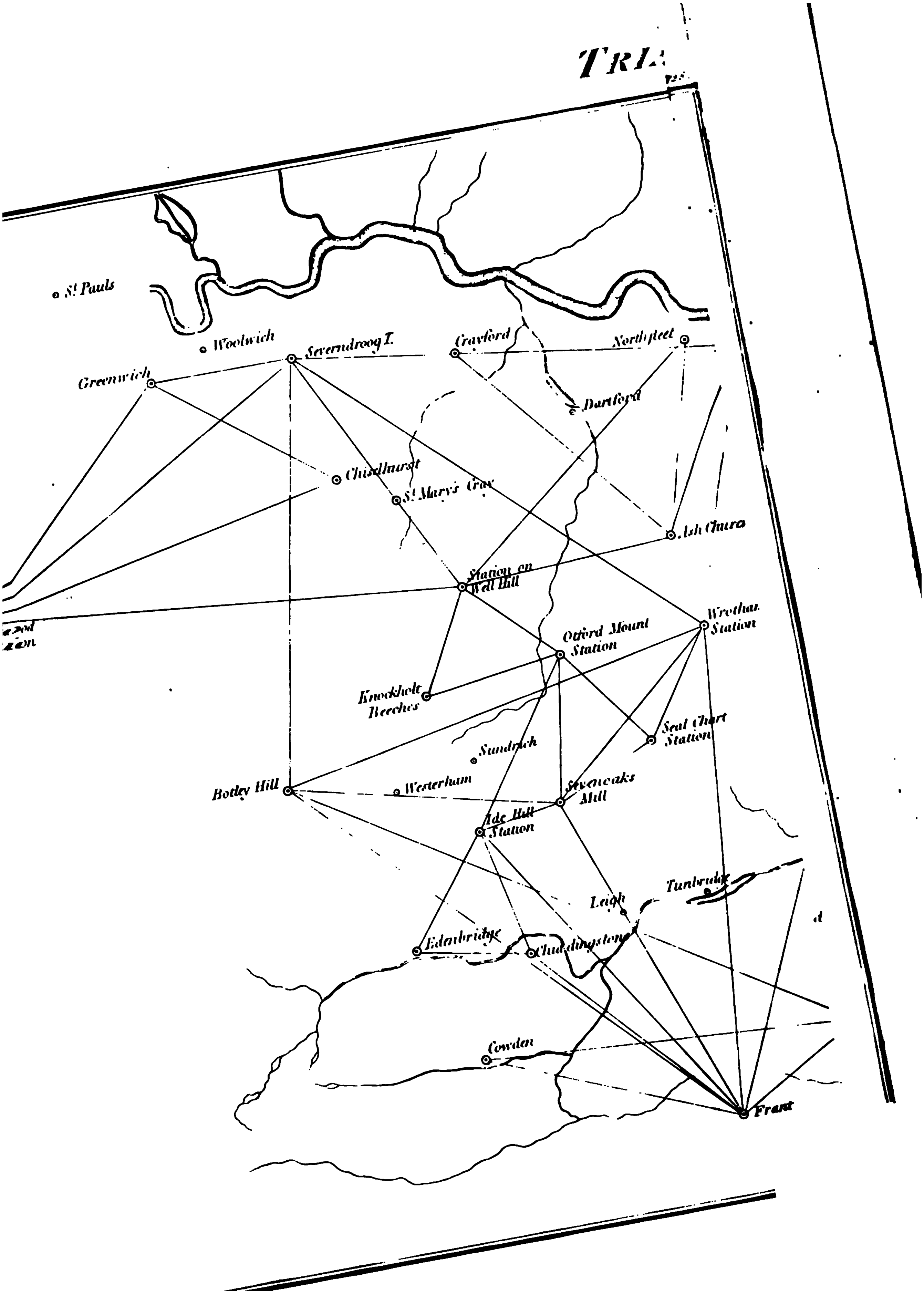
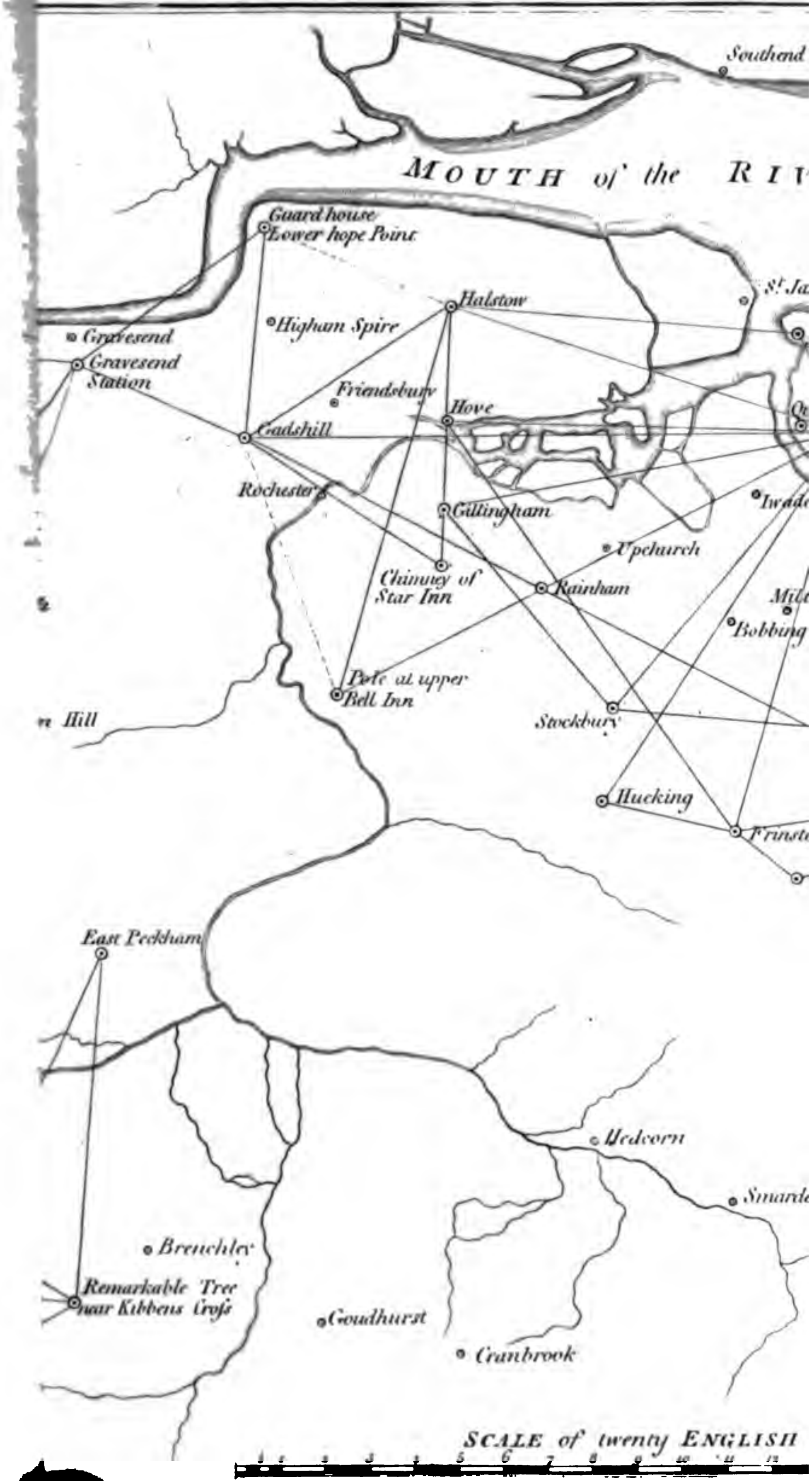
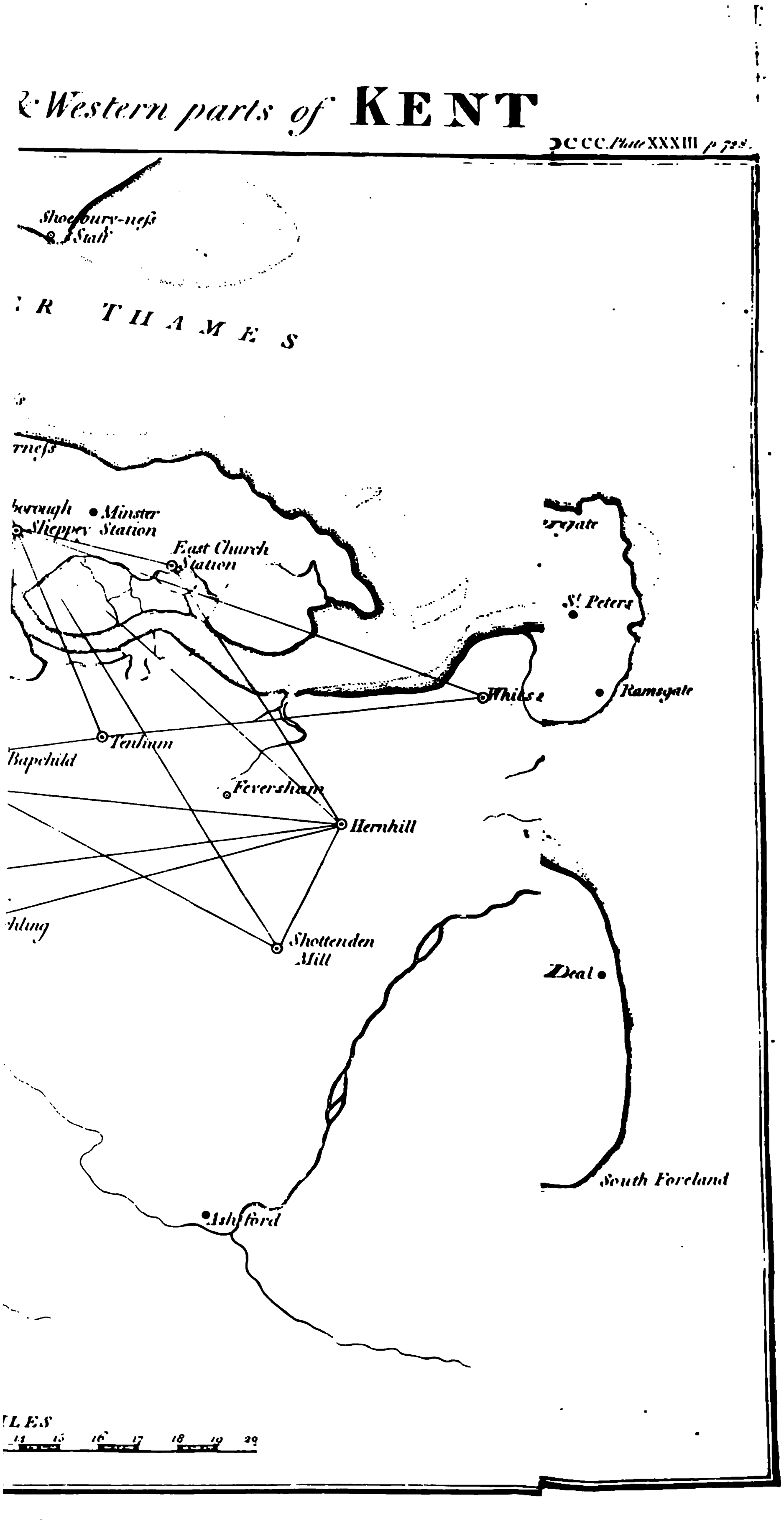

TRI
St. Pauls
Woolwich
Severndroog T.
Crayford
Northfleet
Greenwich
Dartford
Chiselhurst
St. Mary's Cray
Ash Church
Station on Well Hill
Wrotham Station
Otford Mount Station
Knockholt Beeches
Seal Chart Station
Sundridge
Botley Hill
Westerham
Sevenoaks Mill
Ide Hill Station
Leigh
Tunbridge
Edenbridge
Chiddingstone
Cowden
Frant

ANGLES for the Survey of the Northern




& Western parts of KENT
CCC. Plate XXXIII p. 728.
Shoebury-ness Staff
R THAMES
rness
borough Sheppey
Minster Station
East Church Station
St. Peters
Whitst
Ramsgate
Tenham
Bapchild
Feversham
Hernhill
Shottenden Mill
Deal
South Foreland
Ashford
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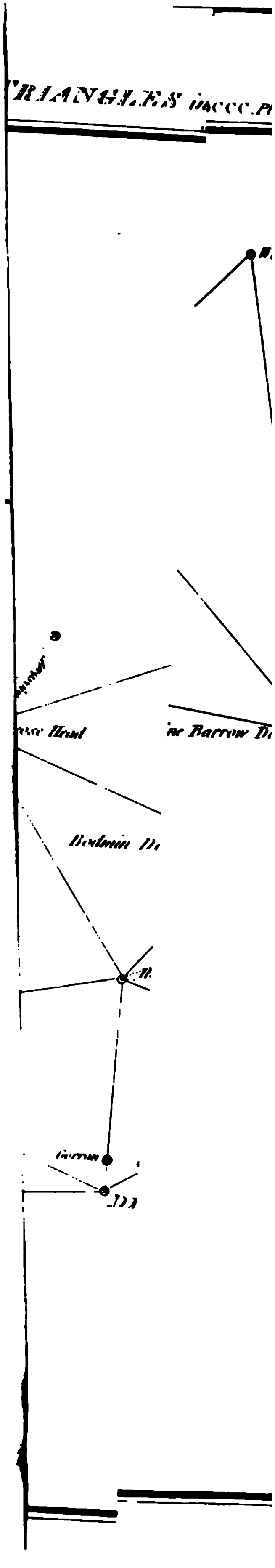
TRIANGLES in CCC. Pl
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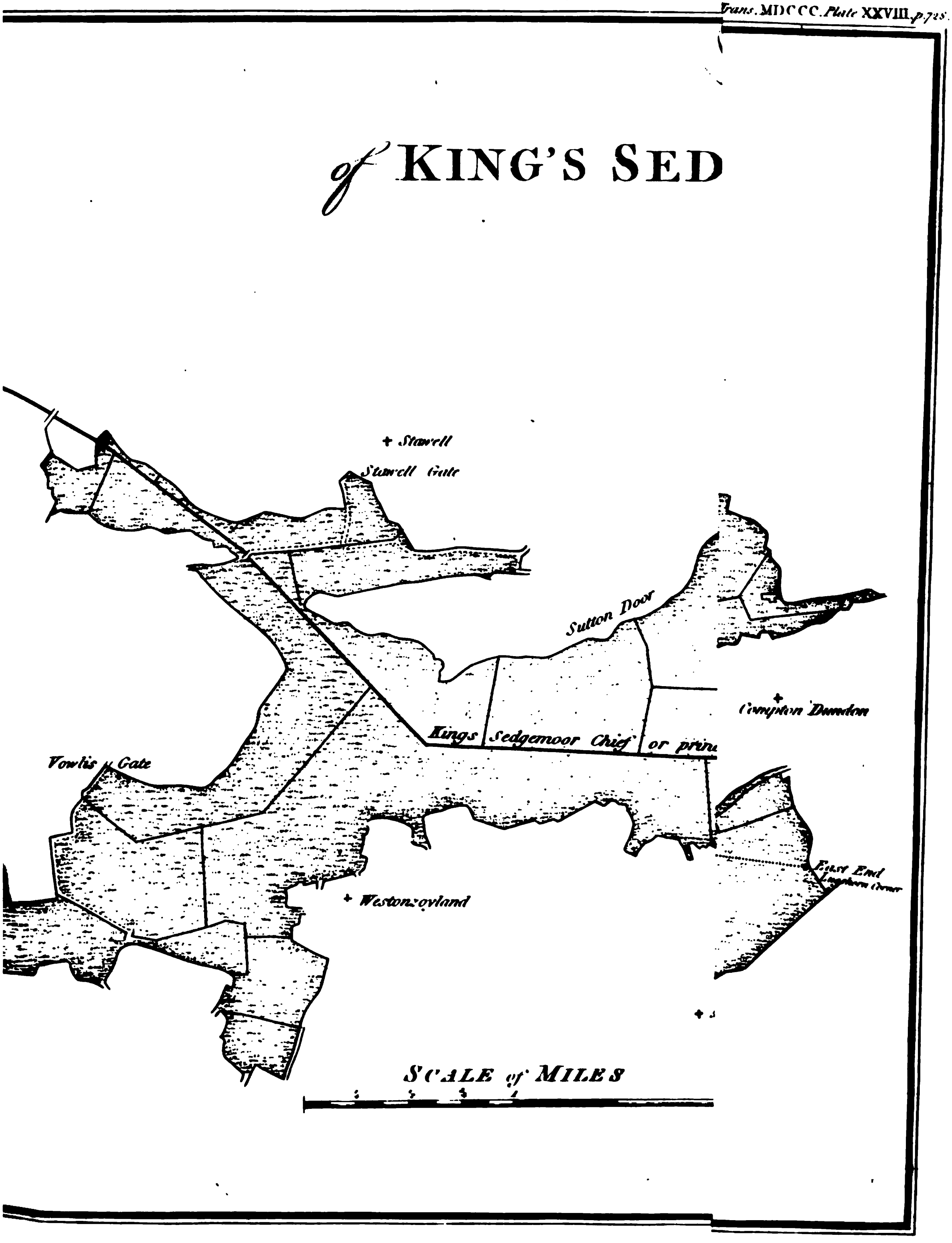
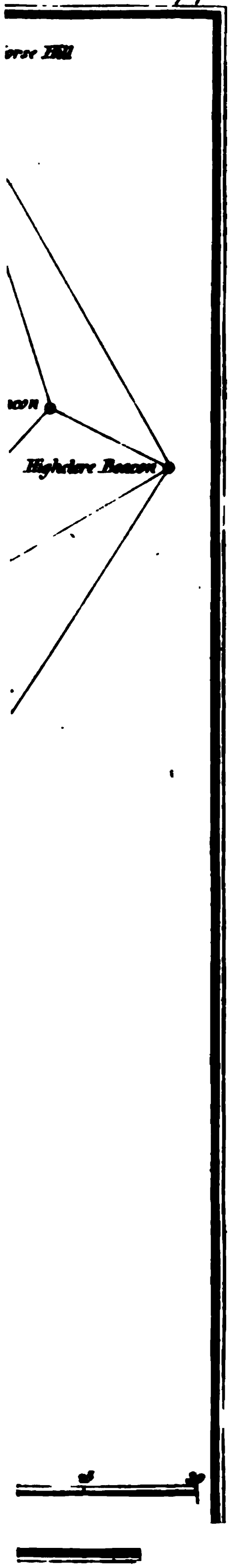
Barrow
Bodmin D
Carron
Da

Trans. MDCCC. Plate XXVIII. p. 725.




orse Hill
con
Highclere Beacon

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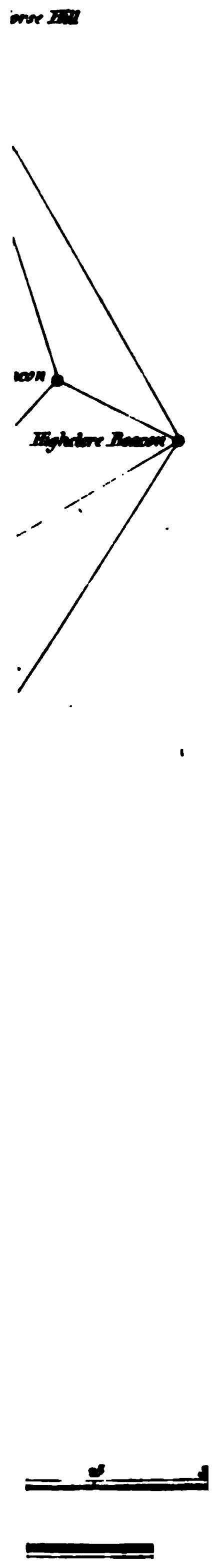
98.

DCCC. *Plate* XXIX. *p*



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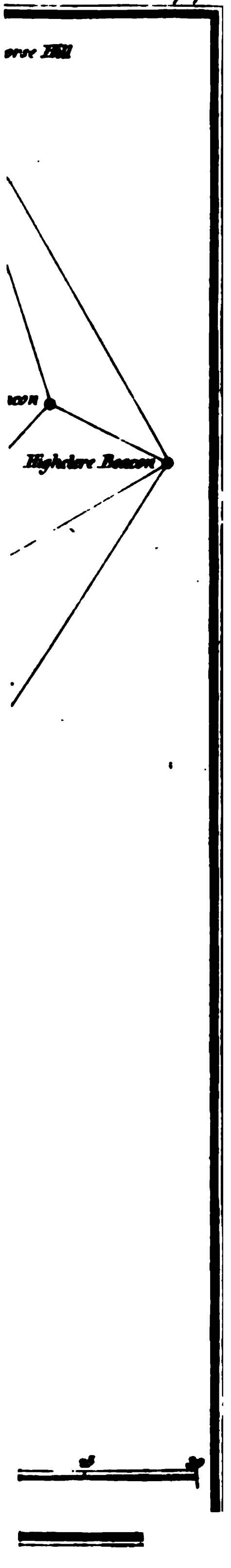
98.

DCCC. *Plate* XXIX. *p.* 728



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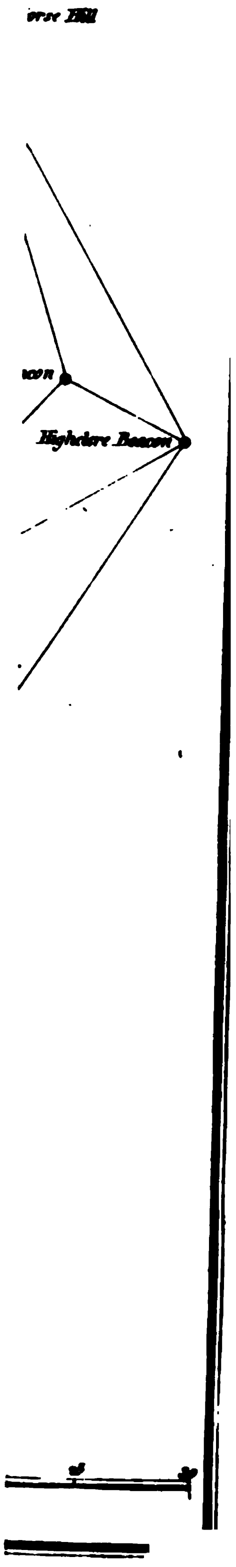
78.

DCCC. *Plate* XXIX. *p*



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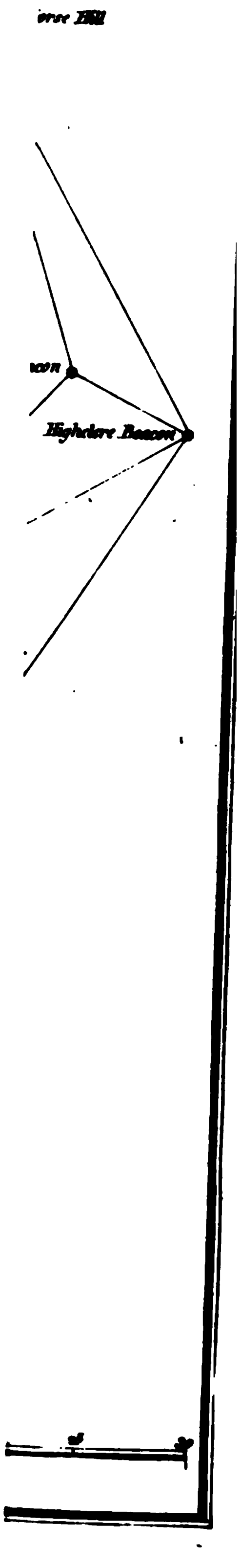
98.

DCCC. *Plate* XXIX. *p.*



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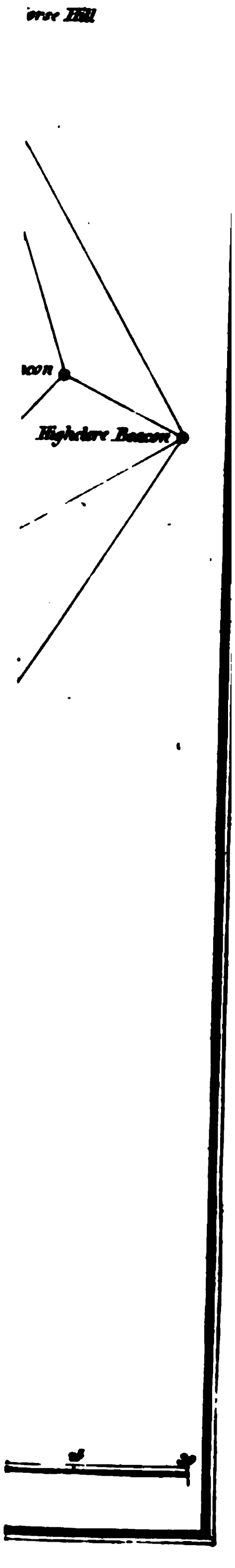
98.

DCCC. *Plate* XXIX. *p.* 7



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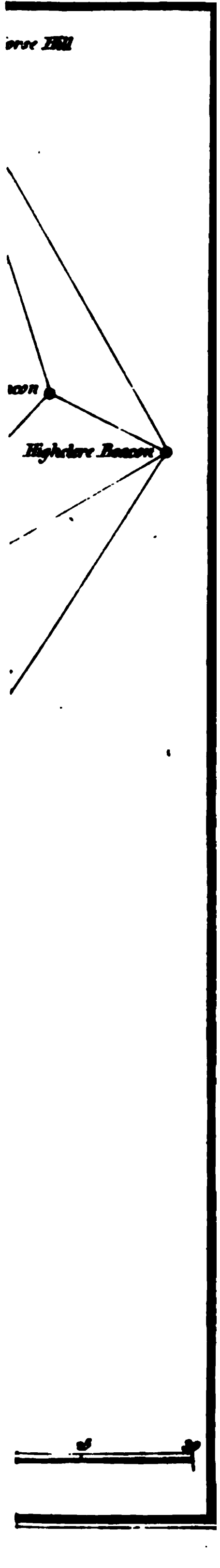
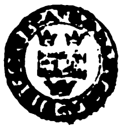
98.

DCCC. *Plate* XXIX *p.7*





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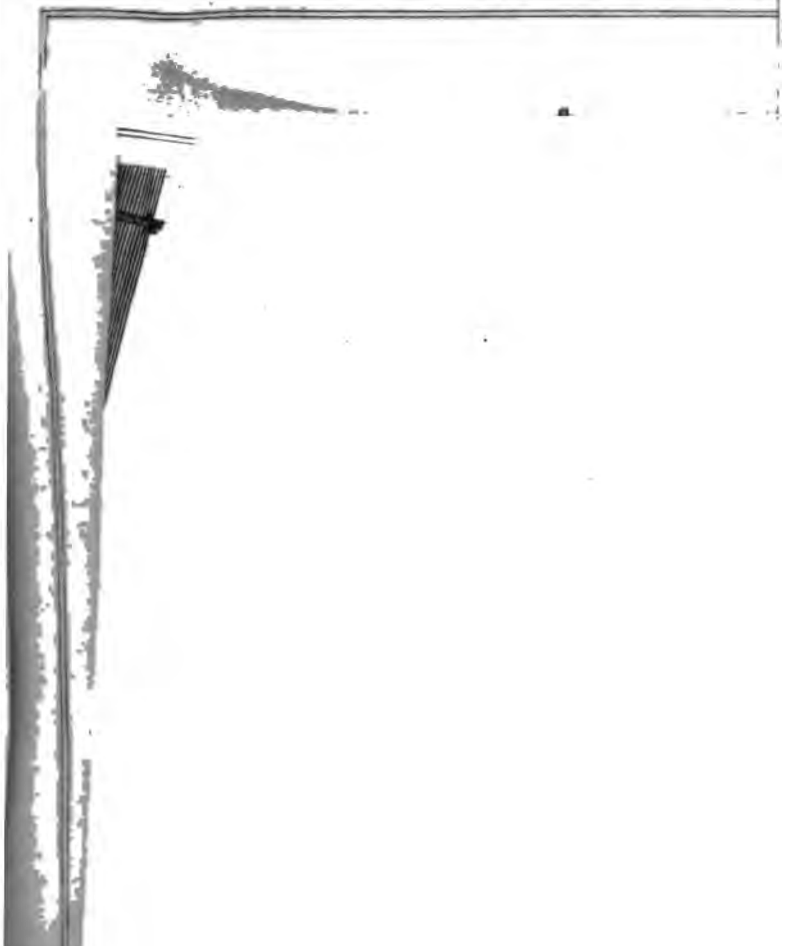

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